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United States Department of Agriculture

Agricultural Research Service

National Agricultural Library

Animal Welfare Information Center

Information Resources on Reptiles

September 2008

Wood Turtle (*Glyptemys insculpta*)

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AWIC Resource Series No. 43

United States Department of Agriculture

Agricultural Research Service

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September 2008

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About this Document

This publication updates and revises the reptiles section of AWIC's "Information Resources on Amphibians, Fish & Reptiles Used in Biomedical Research," AWIC Resource Series No. 10, August 2001 (online: http://www.nal.usda.gov/awic/pubs/amphib.htm).

The citations in this bibliography pertain to the health, care and housing of reptiles owned as pets, exhibited in zoos and aquariums, or used for research.

The Federal Animal Welfare Act defines "animal" as any live or dead dog, cat, nonhuman primate, guinea pig, hamster, rabbit, or any other warmblooded animal, which is being used, or is intended for use for research, teaching, testing, experimentation, or exhibition purposes, or as a pet. It thus excludes reptiles and amphibians from coverage. Some reptiles and amphibians are considered endangered species and are thus protected by CITES and the Endangered Species Act.

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For this document, the compiler searched for citations from multiple sources published between the years 2002 to 2007. The sources of information include peer-reviewed journals, conference proceedings, theses, annual reports, dissertations, books, monographs, and reviews. Some URLs are provided for documents available as eDocuments. Readers are cautioned as to the dynamic nature of the internet and the fact that Web addresses and content are subject to change. All sites are current as of September 2008.

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Acknowledgements
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Anatomy

Abdel Kader, I.Y., A.W.A. El ghareeb, and A.F. Mahgoub (2005). **The cranial nerves of the snake *Natrix tessellata* (Ophidia, Colubridae). The nervi glossopharyngeus, vagus, accessorius and hypoglossus.** *Egyptian Journal of Zoology* 45: 543-573. ISSN: 1110-6344.
Descriptors: reptiles, snake, *Natrix tessellata*, cranial nerves, nervi glossopharyngeus, vagus, hypoglossus, accessorius, anatomy.
Language of Text: Arabic; English.

Abdel Kader, I.Y. (2006). **The cranial nerves of the cat snake *Telescopus dhara* (Colubridae, Ophidia): I. The eye muscle nerves and the ciliary ganglion.** *Journal of the Egyptian German Society of Zoology* 50(B): 1-16. ISSN: 1110-5356.
NAL Call Number: QL1.E49
Descriptors: reptiles, cat snake, *Telescopus dhara*, cranial nerves, ciliary ganglion, anatomy, eye muscle nerves.
Language of Text: Arabic; English.

Abhinav and U.C. Srivastava (2006). **Neuroanatomy of cerebral cortex of an indian lizard, *Mabouia carinata*.** *Journal of Applied Bioscience* 32(2): 160-163. ISSN: 0379-8097.
NAL Call Number: QH301.B59
Descriptors: reptiles, cerebral cortex, indian lizard, neuroanatomy, *Mabouia carinata*, pallium, subpallium.

Aranha, I., M. Bhagya, H.N. Yajurvedi, and B.K. Sagar (2004). **Light microscopical and ultrastructural studies on the vas deferens of the lizard *Mabuya carinata*.** *Journal of Submicroscopic Cytology and Pathology* 36(3-4): 247-256. ISSN: 1122-9497.
Abstract: Adult male lizards (*Mabuya carinata*) were studied during breeding and non breeding seasons to determine the regional and seasonal differences if any in the vas deferens and to compare ultrastructural features of luminal epithelial cells with those of endotherms. The vas deferens of the lizard is a convoluted tube extending from the epididymis to the hemipenis passing over the kidney. Based on morphometric data of luminal diameter and epithelial cell height three distinct regions viz; proximal, middle and distal regions were identified in the vas deferens. The epithelium is surrounded by a thin layer of lamina propria, many layers of circular smooth muscle fibers and an outer layer of visceral pleuro peritoneum. Based on cell and nuclear morphology and ultrastructure, five different cell types viz; principal cell, basal cell, mitochondria rich cell, halo cell and narrow cell were identified in the epithelium during both breeding and non breeding season. Principal cells and basal cells

were more abundant in both seasons. The types of luminal epithelial cells of vas deferens of *M. carinata* and their ultrastructural features are similar to those of mammals. Further, vas deferens of *M. carinata* differs from mammals in having only circular smooth muscles in contrast to circular and longitudinal muscles of mammalian vas deferens. To the best of our knowledge this is the first report describing cell types of vas deferens, their ultrastructure and ultrastructural seasonal variations in reptiles.
Descriptors: reptiles, lizards, anatomy, histology, vas deferens, ultrastructure , epididymis anatomy, epithelial cells ultrastructure, muscle, smooth, ultrastructure.

Arencibia, A., M. Rivero, I.d. Miguel, S. Contreras, A. Cabrero, and J. Oros (2006). **Computed tomographic anatomy of the head of the loggerhead sea turtle (*Caretta caretta*).** *Research in Veterinary Science.* 81(2): 165-169. ISSN: 0034-5288.
Abstract: The heads of three loggerhead sea turtles were disarticulated and imaged immediately to minimize postmortem changes and then frozen and sectioned. For computed tomography (CT) imaging, the heads were positioned in ventral recumbency. Transverse CT images with soft-tissue window were obtained from the olfactory sac region to the temporomandibular joint region. After CT imaging, the heads were sectioned and the gross sections were compared to CT images, to assist in the accurate identification of the anatomic structures. Different clinically relevant anatomic structures were identified and labelled in two series of photographs (CT images and anatomic cross-sections). CT images provided good differentiation between the bones and the soft tissues of the head. The information presented in this paper should serve as an initial reference to evaluate CT images of the head of the loggerhead sea turtle and to assist in the interpretation of lesions of this region.
Descriptors: reptiles, *Caretta caretta*, head, computed-tomography, animal morphology, loggerhead sea turtle, head anatomy.

Bahiani, M., T. Gernigon Spychalowicz, and J.M. Exbrayat (2005). **Structure and ultrastructure of the sexual segment of the kidney in the diurnal Saharan lizard *Uromastix acanthinurus*, Bell 1825.** *Russian Journal of Herpetology* 12(Suppl.): 249-251. ISSN: 1026-2296.
Descriptors: reptiles, diurnal lizard, *Uromastix acanthinurus*, kidney, structure, ultrastructure, Sahara, Algeria.

Bennis, M., J. Reperant, R. Ward, J.P. Rio, S.B.A. M'hamed, and B. Jay (2006). **The postnatal development of the optic nerve of a reptile (*Vipera aspis*): a quantitative ultrastructural study**. *Anatomy and Embryology* 211(6): 691-705. ISSN: 0340-2061.
Descriptors: reptiles, *Vipera aspis*, birds, mammals, optic nerve, postnatal development, axons, ultrastructural study, electron micrographs.

Carvalho, R.C., A.L. Sousa, C.E.B. Moura, T.N. Faria, W.P. Costa, H.R.A. Resende, H.M. Pereira, and A.N.B. Mariana (2003). **Morfologia do penis do jabuti de patas vermelhas (*Geochelone carbonaria* Spix, 1824). [Morphology of the penis of the red-footed tortoise (*Geochelone carbonaria* Spix, 1824)].** *Revista Brasileira De Reproducao Animal* 27(2): 229-230. ISSN: 0102-0803.
NAL Call Number: QP251.R48
Descriptors: reptiles, *Geochelone carbonaria*, anatomy, penis, reproduction, red footed tortoise, morphology, conference information.
Language of Text: Portuguese; Summary in English.
Notes: Meeting Information: XV Congresso Brasileiro de Repoducao Animal, Porto Seguro, Bahia, Brazil; August 11-15, 2003.

Dakrory, A.I. (2005). **The innervation of the olfactory apparatus of the blind snake *Leptotyphlops cairi* (Dumeril and Bibron, 1844).** *Egyptian Journal of Zoology* 45: 201-214. ISSN: 1110-6344.
Descriptors: reptiles, blind snake, *Leptotyphlops cairi*, innervation, olfactory apparatus, jacobson's organ.
Language of Text: Arabic; English.

Dakrory, A.I. and T.G. Abdel Kader (2006). **The cranial nerves of the blind snake *Leptotyphlops cairi*: the nervi glossopharyngeus, vagus, accessorius and hypoglossus.** *Journal of the Egyptian German Society of Zoology* 49(B): 63-86. ISSN: 1110-533X.
NAL Call Number: QL1.E49
Descriptors: reptiles, blind snake, *Leptotyphlops cairi*, cranial nerves, anatomy, accessorius, glossopharyngeus, hypoglossus, vagus, nerves.
Language of Text: Arabic; English.

Delgado, S., T. Davit Beal, F. Allizard, and J.Y. Sire (2005). **Tooth development in a scincid lizard, *Chalcides viridanus* (Squamata), with particular attention to enamel formation.** *Cell and Tissue Research* 319(1): 71-89. ISSN: 0302-766X.
Abstract: Comparative analysis of tooth development in the main vertebrate lineages is needed to determine the various evolutionary routes leading to current dentition in living vertebrates. We have used light, scanning and transmission electron microscopy to study tooth morphology and the main stages of tooth development in the scincid lizard, *Chalcides viridanus*, viz., from late embryos to 6-year-old specimens of a laboratory-bred colony, and from early initiation stages to complete differentiation and attachment, including resorption and enamel formation. In *C. viridanus*, all teeth of a jaw have a similar morphology but tooth shape, size and orientation change during ontogeny, with a constant number of tooth positions. Tooth morphology changes from a simple smooth cone in the late embryo to the typical adult aspect of two cusps and several ridges via successive tooth replacement at every position. First-generation

teeth are initiated by interaction between the oral epithelium and subjacent mesenchyme. The dental lamina of these teeth directly branches from the basal layer of the oral epithelium. On replacement-tooth initiation, the dental lamina spreads from the enamel organ of the previous tooth. The epithelial cell population, at the dental lamina extremity and near the bone support surface, proliferates and differentiates into the enamel organ, the inner (IDE) and outer dental epithelium being separated by stellate reticulum. IDE differentiates into ameloblasts, which produce enamel matrix components. In the region facing differentiating IDE, mesenchymal cells differentiate into dental papilla and give rise to odontoblasts, which first deposit a layer of predentin matrix. The first elements of the enamel matrix are then synthesised by ameloblasts. Matrix mineralisation starts in the upper region of the tooth (dentin then enamel). Enamel maturation begins once the enamel matrix layer is complete. Concomitantly, dental matrices are deposited towards the base of the dentin cone. Maturation of the enamel matrix progresses from top to base; dentin mineralisation proceeds centripetally from the dentin-enamel junction towards the pulp cavity. Tooth attachment is pleurodont and tooth replacement occurs from the lingual side from which the dentin cone of the functional teeth is resorbed. Resorption starts from a deeper region in adults than in juveniles. Our results lead us to conclude that tooth morphogenesis and differentiation in this lizard are similar to those described for mammalian teeth. However, Tomes' processes and enamel prisms are absent.
Descriptors: lizards, growth, development, bone resorption, dental enamel, embryology, dental enamel growth, development, dental enamel ultrastructure, anatomy, histology, embryology, odontogenesis, tooth embryology, tooth growth, development, ultrastructure.

El Ghareeb, A.W.A., I.Y. Abdel Kader, and A.F. Mahgoub (2004). **The cranial nerves of the snake *Natrix tessellata* (Ophidia, Colubridae): the eye muscle nerves and the ciliary ganglion.** *Journal of Union of Arab Biologists Cairo A Zoology* 22: 305-330. ISSN: 1110-5372.
Descriptors: reptiles, *Natrix tessellata*, snake, cranial nerves, eye muscle nerves, ciliary ganglion.
Language of Text: Arabic; English.

Endo, H., R. Aoki, H. Taru, J. Kimura, M. Sasaki, M. Yamamoto, K. Arishima, and Y. Hayashi (2002). **Comparative functional morphology of the masticatory apparatus in the long-snouted crocodiles.** *Anatomia, Histologia, Embryologia* 31(4): 206-213. ISSN: print: 0340-2096; online: 1439-0264.
Abstract: The masticatory muscles and their related structures of the skull were observed in the Indian gavial (*Gavialis gangeticus*), the false gavial (*Tomistoma schlegelii*), and the African slender-snouted crocodile (*Mecistops cataphractus*) to detail some morphological differences in comparison with the other crocodile species,

and to compare and elucidate the functional strategy of themasticatory apparatus in these long-snouted species. The Musculus pterygoideus posterior was relatively smaller in the three species compared with many short-snouted crocodiles. It suggests that the masticatory power in fish-eating long-snouted species is not so high as in the short-snouted crocodiles, while the masticatory muscles were morphologically different among the three long-snouted species as follows. The M. pterygoideus posterior of the false gavial was extended in the lateral side of the lower jaw unlike the Indian gavial. The M. pseudotemporalis and the Fenestra supratemporalis were largely developed in the Indian gavial, however we suggest that the other two species possess the weak bundles in this muscle. The false gavial and the African slender-snouted crocodile have the pterygoid bone well-developed extending dorso-ventrally and it is suggested that the M. adductor mandibulae posterior attached to the pterygoid bone may be much larger than the Indian gavial. These data morphologically clarify the masticatory mechanism in the long-snouted crocodiles different from the short-snouted species, and demonstrate that the evolutional strategy to share the functional role in the masticatory muscles have been differently established between the Indian gavial and the other two species. We also obtained the morphological data in the fossil skull of the Machikane crocodile (*Toyotamaphymeia machikanense*) and concluded from the fossil characters that the considerable developments of the M.pterygoideus posterior and the M.pseudotemporalis in this species had not morphologically been consistent with both the Indian and false gavials.
Descriptors: reptiles, long snouted crocodiles, masticatory apparatus, functional morphology, comparative, Indian gavial, false gaval, slender snouted crocodile, masticatory muscles.

Gal, J., M. Marosan, and D. Winkler (2004). **A hullok kivalaszto keszulekenek anatomiaja, elettana es fontosabb megbetegedesei. [Anatomy, physiology and major diseases of the reptile excretory apparatus].** *KisallatPraxis* 5(1): 22, 24-26. ISSN: 1585-9142.
NAL Call Number: SF981.K573
Descriptors: reptiles, anatomy, physiology, diseases, excetory apparatus, kidneys, intestines.
Language of Text: Hungarian; Summary in English.

Gal, J., A. Antal, E. Sos, and M. Marosan (2003). **A keteltuek es a hullok legzokeszulekenek anatomiaja, elettana es fontosabb betegsegei. Irodalmi attekintes. [Anatomy, physiology and important diseases of the respiratory apparatus of amphibians and reptiles. Literature review.]**. *Magyar Allatorvosok Lapja* 125(3): 165-171. ISSN: 0025-004X.
Descriptors: amphibians, reptiles, anatomy, physiology , important diseases, respi-

ratory apparatus, literature review.
Language of Text: Hungarian.

Gribbins, K.M., C.S. Happ, and D.M. Sever (2005). **Ultrastructure of the reproductive system of the black swamp snake (*Seminatrix pygaea*). V. The temporal germ cell development strategy of the testis.** *Acta Zoologica Copenhagen* 86(4): 223-230. ISSN: 0001-7272.
Descriptors: reptiles, *Seminatrix pygaea*, black swamp snake, reproductive system, ultrastructure, temporal germ cell development, testis.

Guerrero, S.M., M.L. Calderon, G.R. de Perez, and M.P.R. Pinilla (2004). **Morphology of the male reproductive duct system of *Caiman crocodilus* (Crocodylia, Alligatoridae).** *Annals of Anatomy* 186(3): 235-245. ISSN: 0940-9602.
Descriptors: reptiles, crocodile, alligator, *Caiman crocodilus*, male, reproductive duct system, morphology.

Herrel, A., M. Canbek, U. Ozelmas, M. Uyanoglu, and M. Karakaya (2005). **Comparative functional analysis of the hyolingual anatomy in lacertid lizards.** *Anatomical Record. Part A, Discoveries in Molecular, Cellular, and Evolutionary Biology* 284(2): 561-573. ISSN: print: 1552-4884; online: 1552-4892.
NAL Call Number: QL801.A53
Abstract: The tongue is often considered a key innovation in the evolution of a terrestrial lifestyle as it allows animals to transport food items through the oral cavity in air, a medium with low density and viscosity. The tongue has been secondarily coopted for a wide diversity of functions, including prey capture, drinking, breathing, and defensive behaviors. Within basal lizard groups, the tongue is used primarily for the purpose of prey capture and transport. In more derived groups, however, the tongue appears specialized for chemoreceptive purposes. Here we examine the tongue structure and morphology in lacertid lizards, a group of lizards where the tongue is critical to both food transport and chemoreception. Because of the different mechanical demands imposed by these different functions, regional morphological specializations of the tongue are expected. All species of lacertid lizards examined here have relatively light tongue muscles, but a well developed hyobranchial musculature that may assist during food transport. The intrinsic musculature, including verticalis, transversalis, and longitudinalis groups, is well developed and may cause the tongue elongation and retraction observed during chemoreception and drinking. The papillary morphology is complex and shows clear differences between the tongue tips and anterior fore-tongue, and the more posterior parts of the tongue. Our data show a subdivision between the fore- and hind-tongue in both papillary structure and muscular anatomy likely allowing these animals to use their tongues effectively during both chemoreception and prey transport. Moreover, our data suggest the importance of hyobranchium movements during prey transport in lacertid lizards.

Descriptors: lizards, hyoid bone anatomy, histology, lizards anatomy, histology, muscles anatomy, histology, tongue anatomy, histology, physiology.

Hidalgo Sanchez, M., J. Francisco Morcillo, J. Navascues, and G. Martin Partido (2007). **Early development of the optic nerve in the turtle *Mauremys leprosa*.** *Brain Research* 1137(1): 35-49. ISSN: 0006-8993.
Descriptors: reptiles, turtle, *Mauremys leprosa* , optic nerve, early development, electron microscopy, optic axons, growth cones, glial cells.

Hong, M.L., L.R. Fu, H.T. Shi, Y.J. Guo, and X.Y. Zeng (2004). **Anatomy of digestive and respiratory systems in the four eye-spotted turtle.** *Chinese Journal of Zoology* 39(1): 68-71. ISSN: 0250-3263.
Descriptors: reptiles, four eye spotted turtle, digestive system, respiratory system , anatomy.
Language of Text: Chinese; Summary in Chinese and English.

Kik, M.J.L. and M.A. Mitchell (2005). **Reptile cardiology: a review of anatomy and physiology, diagnostic approaches, and clinical disease.** *Seminars in Avian and Exotic Pet Medicine* 14(1): 52-60. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: reptiles, cardiology, review, anatomy, physiology, diagnostic approaches, clinical disease.

Mahler, D.L. and M. Kearney (2006). **The palatal dentition in squamate reptiles: morphology, development, attachment, and replacement.** *Fieldiana Zoology* 108: 1-61. ISSN: 0015-0754.
Descriptors: squamate reptiles, palatal dentition, morphology, development, attachment, replacement, tooth arrangement.

Martin, J., N. Kogo, T.X. Fan, and M. Ariel (2003). **Morphology of the turtle accessory optic system**. *Visual Neuroscience* 20(6): 639-649. ISSN: 0952-5238.
Online: http://dx.doi.org/10.1017/S0952523803206064
Descriptors: reptiles, turtle, accessory optic system, morphology, eyes.

Martinez Marcos, A., I. Ubeda Banon, E. Lanuza, and M. Halpern (2005). **Chemoarchitecture and afferent connections of the "olfactostriatum": a specialized vomeronasal structure within the basal ganglia of snakes.** *Journal of Chemical Neuroanatomy* 29(1): 49-69. ISSN: 0891-0618.
Abstract: The olfactostriatum, a portion of the striatal complex of snakes, is the major tertiary vomeronasal structure in the ophidian brain, receiving substantial afferents from the nucleus sphericus, the primary target of accessory olfactory bulb efferents. In the present study, we have characterized the olfactostriatum of garter

snakes (*Thamnophis sirtalis*) on the basis of chemoarchitecture (distribution of serotonin, neuropeptide Y and tyrosine hydroxylase) and hodology (afferent connections). The olfactostriatum is densely immunoreactive for serotonin and neuropeptide Y and shows moderate-to-weak immunoreactivity for tyrosine hydroxylase. In addition to afferents from the nucleus sphericus, the olfactostriatum receives inputs from the dorsal and lateral cortices, nucleus of the accessory olfactory tract, external and dorsolateral amygdalae, dorsomedial thalamic nucleus, ventral tegmental area and raphe nuclei. Double labeling experiments demonstrated that the distribution of serotonin and neuropeptide Y in this area almost completely overlaps the terminal field of projections from the nucleus sphericus. Also, serotonergic and dopaminergic innervation of the olfactostriatum likely arise, respectively, from the raphe nuclei and the ventral tegmental area, whereas local circuit neurons originate the neuropeptide Y immunoreactivity. These results indicate that the olfactostriatum of snakes could be a portion of the nucleus accumbens, with features characteristic of the accumbens shell, devoted to processing vomeronasal information. Comparative data suggest that a similar structure is present in the ventral striatum of amphibians and mammals.
Descriptors: reptiles, garter snake, *Thamnophis sirtalis*, olfactostriatum, chemoarchitecture, afferent connections, vermeronasalstructure, ganglia.

Mathger, L.M., L. Litherland, and K.A. Fritsches (2007). **An anatomical study of the visual capabilities of the green turtle, *Chelonia mydas*.** *Copeia*(1): 169-179. ISSN: 0045-8511.
Descriptors: reptiles, green turtle, *Chelonia mydas*, visual capabilities, anatomical study, retinal anatomy, electron microscopy, ocular media.

Mohammed, M.B.H., F.I. El Sayad, A.M. Abo El Naga, and Y.A. Fouda (2006). **Structure and function of the tongue in some scincid lizards.** *Journal of the Egyptian German Society of Zoology* 50(B): 47-66. ISSN: 1110-5356.
NAL Call Number: QL1.E49
Descriptors: reptiles, scincid lizards, *Chalcides ocellatus*, *Eumeces schneiderii*, *Sphenops sepsoides*, *Scincus scincus*, *Mabuya vittata*, tongue, structure, function.
Language of Text: Arabic; English.

Putterill, J.F. and J.T. Soley (2004). **General morphology of the oral cavity of the Nile crocodile, *Crocodylus niloticus* (Laurenti, 1768). II. The tongue.** *Onderstepoort Journal of Veterinary Research.* 71(4): 263-277. ISSN: 0030-2465.
NAL Call Number: 41.8 On1
Abstract: The heads of nine 2.5 to 3-year-old Nile crocodiles (*Crocodylus niloticus*) were obtained from a commercial farm where crocodiles are raised for their skins and meat. The animals from which these specimens were obtained appeared clinically healthy at the time they were slaughtered. A description of the macroscopic and microscopic features of the tongue of the Nile crocodile is presented and the results

are compared with published information on this species and other Crocodylia. The histological features are supplemented by information supplied by scanning electron microscopy. Macroscopic features of interest were the dome shaped structures grouped in a triangular formation on the posterior two-thirds of the dorsum of the tongue. These structures were identified by light microscopy to contain well-developed branched, coiled tubular glands and associated lymphoid tissue. Other histological features included a lightly keratinised stratified squamous surface epithelium supported by a thick layer of irregular dense fibrous connective tissue. Deep to this region was a clearly demarcated adipose tissue core with a dense mass of striated lingual musculature. Localised thickenings were present in the epithelium which were associated with ellipsoid intra-epithelial structures resembling taste buds.
Descriptors: reptiles, Nile crocodile, *Crocodylus niloticus*, oral cavity, anatomy, genral morphology, tongue, histological features, macroscopic, microscopic.

Putterill, J.F. and J.T. Soley (2003). **General morphology of the oral cavity of the Nile crocodile, *Crocodylus niloticus* (Laurenti, 1768). I. Palate and gingivae.** *Onderstepoort Journal of Veterinary Research.* 70(4): 281-297. ISSN: 0030-2465.
NAL Call Number: 41.8 On1
Abstract: The heads of nine 2.5 to 3-year-old Nile crocodiles (*Crocodylus niloticus*) were obtained from a commercial farm where crocodiles are raised for their skins and meat. The animals from which these specimens originated were clinically healthy at the time they were slaughtered. A detailed description of the macroscopic and microscopic features of the palate and gingivae of the Nile crocodile is presented and the results are compared with published information on this species and other Crocodylia. The histological features are supplemented by information supplied by scanning electron microscopy. Macroscopic features of interest are the small conical process situated at the base of the first two incisors of the maxilla, the distribution of cobbled units on the palate, and the broad dentary shelf forming the rostral aspect of the mandible. Histologically the palate and gingivae did not differ significantly from each other and both regions showed a presence of Pacinian-type corpuscles. Two types of sensory structures (taste receptors and pressure receptors) were identified in the regions examined, both involving modification of the epithelium and the underlying connective tissue.
Descriptors: reptiles, Nile crocodile, *Crocodylus niloticus*, oral cavity, general morphology, palate, gingivae, features, macroscopic, microscopic.

Su, Z.h., X.w. Chen, and Q.s. Chen (2006). **Ultrastructure of mucosal epithelium in intestine of soft-shelled turtle, *Trionyx sinensis*.** *Chinese Journal of Veterinary Science* 26(1): 82-85 Sum No 121. ISSN: 1005-4545.
NAL Call Number: SF604.C58
Descriptors: reptiles, soft shelled turtle, *Trionyx sinensis*, mucosal epithelium, ultra-

structure, intestine.
Language of Text: Chinese; Summary in Chinese and English.

Suzuki, D., G. Murakami, and N. Minoura (2002). **Histology of the bone-tendon interfaces of limb muscles in lizards.** *Annals of Anatomy; Anatomischer Anzeiger Official Organ of the Anatomische Gesellschaft* 184(4): 363-377. ISSN: 0940-9602.
Abstract: Lizards exhibit continual bone growth at the epiphysis, and their limb muscles are distributed differently from those of mammals because of differences in weight bearing. We therefore characterized the bone-tendon (B-T) interface (also termed the enthesis) in lizards. Using the forelimbs of five monitor lizards and three iguanas, we performed histological investigations on 57 B-T interfaces. Most reptilian tendons were very short and were often composed of wavy fiber bundles. Fibrocartilage (FC)-mediated direct insertion was observed at all epiphyses, whereas periosteum-mediated indirect insertions, including fleshy attachments, were often located on the flat surfaces of the pectoral girdles and at the diaphyses of the limb bones. The reptilian B-T interface was characterized by variability in the morphology of the FC-mediated insertions, especially by morphologies intermediate between those of FC- and periosteum-mediated interfaces; i.e., 1) various degrees of absence of the clear FC zonation seen in mammals, including the tidemark; 2) involvement of the periosteum in the FC; 3) the presence of various types of FC cells in the tendon near the interface, to reinforce the tendon against compression or shear stress; and 4) both FC and hyaline cartilage (lateral articular cartilage) receiving the tendon at the epiphysis. Overall, variations in the connective tissue, especially the FC tissue, were very evident in the reptilian B-T interface. The specific structures of the interfaces probably represent adaptations to the continuous growth and loose joint structures of lizards.
Descriptors: reptiles, lizards, iguanas, continual bone growth, limb muscles, bone-tendon, weight bearing, fleshy attachments, histology.

Torres Carvajal, O. (2004). **The abdominal skeleton of Tropidurid lizards (Squamata: Tropiduridae).** *Herpetologica* 60(1): 75-83. ISSN: 0018-0831.
NAL Call Number: QL640.H4
Descriptors: reptiles, Tropidurid lizards, abdominal skeleton, Squamata, ribs, attachment.

Uriona, T.J., C.G. Farmer, J. Dazely, F. Clayton, and J. Moore (2005). **Structure and function of the esophagus of the American alligator (*Alligator mississippiensis*).** *Journal of Experimental Biology* 208(16): 3047-3053. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01746
NAL Call Number: 442.8 B77
Descriptors: reptiles, American alligator, *Alligator mississippiensis*, esophagus, structure, function.

Valente, A.L., R. Cuenca, M.A. Zamora, M.L. Parga, S. Lavin, F. Alegre, and I. Marco (2006). **Sectional anatomic and magnetic resonance imaging features of coelomic structures of loggerhead sea turtles.** *American Journal of Veterinary Research* 67(8): 1347-1353. ISSN: 0002-9645.

NAL Call Number: 41.8 Am3A

Abstract: OBJECTIVE: To compare cross-sectional anatomic specimens with images obtained via magnetic resonance imaging (MRI) of the coelomic structures of loggerhead sea turtles (*Caretta caretta*). ANIMALS: 5 clinically normal live turtles and 5 dead turtles. PROCEDURES: MRI was used to produce T1- and T2-weighted images of the turtles, which were compared with gross anatomic sections of 3 of the 5 dead turtles. The other 2 dead turtles received injection with latex and were dissected to provide additional cardiovascular anatomic data. RESULTS: The general view on the 3 oriented planes provided good understanding of cross-sectional anatomic features. Likewise, major anatomic structures such as the esophagus, stomach, lungs, intestine (duodenum and colon), liver, gallbladder, spleen, kidneys, urinary bladder, heart, bronchi, and vessels could be clearly imaged. It was not possible to recognize the ureters or reproductive tract. CONCLUSIONS AND CLINICAL RELEVANCE: By providing reference information for clinical use, MRI may be valuable for detailed assessment of the internal anatomic structures of loggerhead sea turtles. Drawbacks exist in association with anesthesia and the cost and availability of MRI, but the technique does provide excellent images of most internal organs. Information concerning structures such as the pancreas, ureters, intestinal segments (jejunum and ileum), and the reproductive tract is limited because of inconsistent visualization.

Descriptors: loggerhead sea turtles, *Caretta caretta*, abdomen anatomy, histology, magnetic resonance imaging, turtles anatomy, histology, MRI.

Wassif, E.T. (2002). **Ultrastructure of the lingual epithelium of adult scincine lizard *Chalcides ocellatus*.** *Egyptian Journal of Biology* 4: 76-86. ISSN: 1110-6859.

Online: http://www.nottingham.ac.uk/%7Eplzfg/EBBSoc/ejb4/Wassif_2002.pdf

Descriptors: adult scincine reptiles, lizard, *Chalcides ocellatus*, lingual epithelium, adult, ultrastructure.

Wyneken, J. and D. Mader (2004). **Clinical applications: Reptile skeletal system**. *Proceedings of the North American Veterinary Conference* 18: 1358-1360. ISSN: 0003-1488.

NAL Call Number: SF605.N672

Descriptors: reptiles, anatomy, skeletal system, bone fractures, cartilage, fracture fixation, ligaments, musculoskeletal system, surgery.

Notes: In the volume: Small Animal and Exotics. Book two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Wyneken, J. and D. Witherington (2003). **Snake anatomy**. *Exotic DVM* 5(5): 26-32. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, snake, *Constrictor constrictor*, *Elaphe obsoleta*, anatomy, arteries, musculoskeletal system, veins.

Zhang, Y.p., X.p. Ying, and X. Ji (2005). **Ultrastructure of the spermatozoon of the northern grass lizard (*Takydromus septentrionalis*) with comments on the variability of sperm morphology among lizard taxa.** *Zoological Research* 26(5): 518-526. ISSN: 0254-5853.
Online: http://www.bioline.org.br/abstract?id=zr05047&lang=en
NAL Call Number: QL1.T85
Descriptors: reptiles, northern grass lizard, *Takydromus septentrionalis*, spermatozoon, ultrastructure, sperm mprphology, variability, comments.
Language of Text: Chinese; Summary in Chinese and English.

Zhu, D. and J. Keifer (2005). **Distribution of facial motor neurons in the pond turtle *Pseudemys scripta elegans*.** *Neuroscience Letters* 373(2): 134-137. ISSN: 0304-3940.
Abstract: A tract tracing study was performed to examine the localization of the facial nucleus in the brain stem of the pond turtle, *Pseudemys scripta elegans*. Neurobiotin and the fluorescent tracers alexa fluor 488 and 594 were used to retrogradely label neurons of the abducens or facial nerves. The results showed that the facial nucleus has two subnuclei, a medial group and a lateral group. Measurements of cell size revealed no significant differences between these populations. Double labeling studies showed that the medial cell group of the facial nucleus lies between the principal and accessory abducens nuclei in the pons, whereas the lateral group lies adjacent to the accessory abducens nucleus. The facial nucleus of pond turtles largely overlaps the rostrocaudal extent of the accessory abducens nucleus, but extends well beyond it into the medulla. These data elucidate the position and distribution of the facial nucleus in the brain stem of pond turtles and contribute to the body of comparative neuroanatomical literature on the distribution of the cranial nerve nuclei of reptiles.
Descriptors: pond turtle, *Pseudemys scripta elegans*, facial nerve, cytology, motor neurons, neural pathways, turtles anatomy, histology.

Ziegler, T. and S. Olbort (2004). **Genitalstrukturen und Geschlechtsunterscheidung bei Krokodilen. [Genitalia structures and sex differentiation in crocodiles.]**. *Draco* 5(4): 39-47 Nr 20. ISSN: 1439-8168.
Descriptors: reptiles, crocodiles, sex differentiation, genitalia structures, genital differences.
Language of Text: German.

Anesthesia and Analgesia

Barter, L.S., M.G. Hawkins, R.J. Brosnan, J.F. Antognini, and B.H. Pypendop (2006). **Median effective dose of isoflurane, sevoflurane, and desflurane in green iguanas.** *American Journal of Veterinary Research* 67(3): 392-397. ISSN: 0002-9645.
NAL Call Number: 41.8 Am3A
Descriptors: reptiles, *Iguana iguana*, anesthesia, isoflurane, dose response, breathing, drug delivery systems, cardiovascular system, duration, adverse effects, pharmacokinetics, sevoflurane, desflurane.

Brosnan, R.J., B.H. Pypendop, L.S. Barter, and M.G. Hawkins (2006). **Pharmacokinetics of inhaled anesthetics in green iguanas (*Iguana iguana*).** *American Journal of Veterinary Research* 67(10): 1670-1674. ISSN: 0002-9645.
NAL Call Number: 41.8 Am3A
Descriptors: reptiles, green iguanas, *Iguana iguana*, inhaled anesthetics, pharmacokinetics.

Chittick, E.J., M.A. Stamper, J.F. Beasley, G.A. Lewbart, and W.A. Horne (2002). **Medetomidine, ketamine, and sevoflurane for anesthesia of injured loggerhead sea turtles: 13 cases (1996-2000).** *Journal of the American Veterinary Medical Association* 221(7): 1019-1025. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Abstract: OBJECTIVE: To determine safety and efficacy of an anesthetic protocol incorporating medetomidine, ketamine, and sevoflurane for anesthesia of injured loggerhead sea turtles. DESIGN: Retrospective study. ANIMALS: 13 loggerhead sea turtles. PROCEDURE: Anesthesia was induced with medetomidine (50 microg/kg [22.7 microg/lb], IV) and ketamine (5 mg/kg (2.3 mg/lb], IV) and maintained with sevoflurane (0.5 to 2.5%) in oxygen. Sevoflurane was delivered with a pressure-limited intermittent-flow ventilator. Heart rate and rhythm, end-tidal partial pressure of CO2, and cloacal temperature were monitored continuously; venous blood gas analyses were performed intermittently. Administration of sevoflurane was discontinued 30 to 60 minutes prior to the end of the surgical procedure. Atipamezole (0.25 mg/kg [0.11 mg/lb], IV) was administered at the end of surgery. RESULTS: Median induction time was 11 minutes (range, 2 to 40 minutes; n = 11). Median delivered sevoflurane concentrations 15, 30, 60, and 120 minutes after intubation were 2.5 (n = 12), 1.5 (12), 1.25 (12), and 0.5% (8), respectively. Heart rate decreased during surgery to a median value of 15 beats/min (n = 11). End-tidal partial pressure of CO2 ranged from 2 to 16 mm Hg (n = 8); median blood gas values were within reference limits. Median time from atipamezole administration to extubation was 14 minutes (range, 2 to 84 minutes; n = 7). CONCLUSIONS AND CLINICAL RELEVANCE: Results suggest that a combination of medetomidine and ketamine for induction and sevoflurane for maintenance provides safe, effective, controllable anesthesia in injured loggerhead sea turtles.
Descriptors: reptiles, loggerhead sea turtles, anesthesia, medetomidine, ketamine, sevoflurane, drug combination, induction, maintenance.

Edling, T.M. (2003). **Advances in anesthesia monitoring in birds, reptiles and small mammals**. *Exotic DVM* 5(3): 15-20. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, anesthesia, advances, monitoring, birds, small mammals, meeting.
Notes: Meeing Information: International Conference on Exotics (ICE2003), Palm Beach, Florida, USA, 2003.

Hawkins, M.G. (2006). **The use of analgesics in birds, reptiles, and small exotic mammals.** *Journal of Exotic Pet Medicine* 15(3): 177-192. ISSN: 1557-5063.
NAL Call Number: SF994.2.A1 S36
Descriptors: reptiles, birds, small exotic mammals, analgesic use, veterinarians, pain, alleviation.

Hernandez Divers, S.J., H. Wilson, M. McBride, and K. Grant (2003). **Sedation/restraint of small lizards and snakes**. *Exotic DVM* 5(5): 9. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, snakes, small lizards, sedation, restraint, anesthesia, anesthetics, analgesia, techniques.

Hernandez Divers, S.M., J. Schumacher, S. Stahl, and S.J. Hernandez Divers (2005). **Comparison of isoflurane and sevoflurane anesthesia after premedication with butorphanol in the green iguana (*Iguana iguana*).** *Journal of Zoo and Wildlife Medicine* 36(2): 169-175. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, green iguana, *Iguana iguana*, anesthesia, sedation, isoflurane, sevoflurane, butorphanol, premedication, comparison, evaluation.

Hernandez Divers, S.M., J. Schumacher, S. Stahl, and S.J. Hernandez Divers (2004). **Reptile clinical anesthesia: Advances in research.** *Exotic DVM* 6(3): 64-69. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, clinical anesthesia, analgesia, sedation, advances, research.

Longley, L. (2004). **Practitioner's guide to reptile anaesthesia**. *Veterinary Times* 34(31): 22-23. ISSN: 1352-9374.
Descriptors: reptiles, anesthesia, analgesia, dosage and administration.

Longley, L. (2004). **Reptile analgesia**. *Veterinary Times* 34(25): 30. ISSN: 1352-9374.
Descriptors: reptiles, anesthetics, analgesics, antagonists, ketamine, non steroidal anti-inflammatory agents, opioids, pain, pharmacodynamics.

Mauthe von Degerfeld, M. (2004). **Personal experiences in the use of association tiletamine/zolazepam for anaesthesia of the green iguana (*Iguana iguana*).** *Veterinary Research Communications* 28(1): 351-353 (Suppl). ISSN: 0165-7380.
Descriptors: reptiles, green iguana, *Iguana iguana*, sedation, anesthesia, analgesia, tiletamine, zolazepam.

Mosley, C.A., D. Dyson, and D.A. Smith (2004). **The cardiovascular dose-response effects of isoflurane alone and combined with butorphanol in the green iguana (*Iguana iguana*).** *Veterinary Anaesthesia and Analgesia* 31(1): 64-72. ISSN: print: 1467-2987; online: 1467-2995.

NAL Call Number: SF914.V47

Abstract: OBJECTIVE: To assess the cardiovascular effects (arterial blood pressure, heart rate, and metabolic acid-base status) of three doses (MAC multiples) of isoflurane alone and combined with butorphanol in the green iguana (*Iguana iguana*). STUDY DESIGN: Prospective randomized double-blind, two-period cross-over trial. ANIMALS: Six mature healthy green iguanas (*Iguana iguana*). METHODS: The iguanas received each of two treatments, saline 0.1 mL kg(-1) (SAL) and butorphanol 1.0 mg kg(-1) (BUT) during isoflurane anesthesia. Treatments were separated by at least 1 week. The iguanas were exposed to each of the three minimum alveolar concentration (MAC) multiples (1.0, 1.5, and 2.0) in random order. Anesthesia was induced with isoflurane and maintained using controlled ventilation. Instrumentation included use of an ECG, airway gas monitor, cloacal thermometer, esophageal pulse oximeter, and the placement of a femoral arterial catheter. Body temperature was stabilized and maintained at 32 degrees C. The treatment was administered, and the animals were equilibrated for 20 minutes at each MAC multiple. At each concentration, the heart rate, blood pressure (systolic, mean, diastolic), end-tidal CO2, and SpO2 were measured. At 1.0 and 2.0 MAC, simultaneous blood samples were drawn from the tail vein/artery complex and femoral catheter for blood gas analysis. Data were analyzed using a two-way analysis of variance for repeated measures looking for differences between treatments and among MAC multiples. RESULTS: There were no significant differences in any of the cardiovascular variables between the treatments. Significant differences among isoflurane MAC multiples were observed for HR, mean, diastolic, and systolic blood pressures. Blood pressure and heart rate decreased with an increasing dose of anesthetic. There were no significant differences between treatments or MAC multiples for any of the blood gas variables. The blood pH, PCO2, HCO3-, and hemoglobin saturation differed significantly between sites. Pulse oximetry values measured from the carotid complex did not correlate with and were significantly different from the calculated hemoglobin saturation values determined using the gas analyzer. CONCLUSION AND CLINICAL RELEVANCE: Cardiovascular depression associated with isoflurane anesthesia in the green iguana is dose dependent. The degree of cardiovascular depression was not significantly different when isoflurane was combined with butorphanol. This finding suggests that the pre-emptive or intraoperative use of butorphanol is unlikely to be detrimental to cardiovascular function. Butorphanol may be a useful anesthetic adjunct to isoflurane anesthesia in the green iguana.

Descriptors: green iguana, *Iguana iguana*, iguanas, analgesics, inhalation anesthetics, blood pressure, drug effects, butorphanol, heart rate, isoflurane.

Mosley, C.A.E., D. Dyson, and D.A. Smith (2003). **The cardiac anesthetic index of isoflurane in green iguanas**. *Journal of the American Veterinary Medical Association* 222(11): 1565-1568. ISSN: 0003-1488.

NAL Call Number: 41.8 Am3

Descriptors: reptiles, green iguanas, isoflurane, cardiac anesthetic index, butorphanol , induction of anesthesia, cardiovascular arrest.

Mosley, C.A.E., D. Dyson, and D.A. Smith (2003). **Minimum alveolar concentration of isoflurane in green iguanas and the effect of butorphanol on minimum alveolar concentration**. *Journal of the American Veterinary Medical Association* 222(11): 1559-1564. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Descriptors: reptiles, green iguanas, isoflurane, minimum alveolar concentration, butorphanol, effect on mimimum alveolar concentration.

Mosley, C.A.E. (2005). **Anesthesia and analgesia in reptiles.** *Seminars in Avian and Exotic Pet Medicine* 14(4): 243-262. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: reptiles, anesthesia, analgesia, sedation, review.

Nagaraja, B.N., S.M. Usturge, S.D. Sonwane, and M.G. Manjunath (2003). **Ketamine hydrochloride for fish hook retrieval in a turtle under field conditions.** *Indian Veterinary Journal* 80(5): 443-444. ISSN: 0019-6479.
NAL Call Number: 41.8 IN2
Descriptors: reptiles, turtle, fish hook retrieval, ketamine hyrochloride, field conditions.

Nevarez, J.G., G.R. Pettifer, and M.A. Mitchell (2002). **Anesthesia case of the month. A suitable choice for anesthetic management of a green iguana for an orchidectomy.** *Journal of the American Veterinary Medical Association* 220(7): 982-985. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Descriptors: reptiles, green iguana, anesthesia, orchidectomy, anesthetic management, case of the month.

Park, I.S., S.H. Cho, J.W. Hur, G.C. Choi, S.Y. Oh, D.S. Kim, and J.S. Lee (2006). **Lidocaine hydrochloride-sodium bicarbonate as an anesthetic for soft-shelled turtle *Pelodiscus sinensis*.** *Fisheries Science Tokyo* 72(1): 115-118. ISSN: 0919-9268.
Descriptors: reptiles, soft shelled turtle, *Pelodiscus sinensis*, sedation, anesthetic, lidocaine hydrochloride, sodium bicarbonate, effect.

Read, M.R. (2004). **Evaluation of the use of anesthesia and analgesia in reptiles.** *Journal of the American Veterinary Medical Association* 224(4): 547-552. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Abstract: OBJECTIVE: To determine anesthetic techniques and the drugs used to provide anesthesia and analgesia to reptiles. DESIGN: Mail-out questionnaire. SAMPLE POPULATION: 367 members of the Association of Reptile and Amphibian Veterinarians. PROCEDURE: 1,091 members listed in the 2002 directory of the Association of Reptile and Amphibian Veterinarians were asked to complete a questionnaire regarding anesthesia and analgesia. RESULTS: 367 of 1,091 (33.6%) individuals completed the questionnaire; 88.8% used inhalants (particularly isoflurane) for anesthesia, and ketamine, propofol, and

butorphanol were the most commonly used injectable agents. Intubation, fluids, and having a dedicated anesthetist were most commonly used for patient support, and pulse oximetry and Doppler ultrasonography were most commonly used for monitoring. Respiratory depression, difficulty monitoring anesthetic depth, prolonged recovery, and hypothermia were the most frequent complications. Nearly all respondents believed that reptiles feel pain, but analgesics were used infrequently for many reasons. CONCLUSIONS AND CLINICAL RELEVANCE: Providing anesthesia in reptiles is difficult, especially regarding anesthetic depth and vital parameters, and methods of support are used less frequently than in domestic species. Provision of analgesia is uncommon. Research regarding pain and its assessment, response to analgesics, and drug pharmacokinetics is needed. Dissemination of this information to practitioners needs to be improved for enhancement of the standard of care for reptiles.
Descriptors: reptiles, anesthesia, analgesia, evaluation of use, drugs, techniques, questionnaire, isoflurans, ketamine, propofol, butorphanol, inhalants, injectable, respiratory depression, hypothermia, prolonged recovery, depth of anesthesia.
Notes: Comment In: J Am Vet Med Assoc. 2004 Apr 15;224(8):1245; author reply 1245.

Rosenthal, K. (2004). **Reptile pain management - is there such a thing?** *Proceedings of the North American Veterinary Conference* 18: 1342. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, pain management, anesthesia, analgesia, drugs.
Notes: In the Volume: Small Animal and Exotics Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Schumacher, J. (2002). **Sevoflurane in reptiles.** *Proceedings of the North American Veterinary Conference* 16(16): 950. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, inhaled anesthetics, sevoflurane, meeting, veterinary.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Schumacher, J. (2002). **Anesthesia of reptiles.** *Proceedings of the North American Veterinary Conference* 16(16): 946-947. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, anesthesia, analgesia, pain, monitoring, meeting.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Sladky, K.K., V. Miletic, J. Paul Murphy, M.E. Kinney, R.K. Dallwig, and S.M. Johnson (2007). **Analgesic efficacy and respiratory effects of butorphanol and morphine in turtles.** *Journal of the American Veterinary Medical Association* 230(9): 1356-1362. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Abstract: OBJECTIVE: To test the hypothesis that butorphanol or morphine induces antinociception with minimal respiratory depression in conscious red-eared slider turtles.

DESIGN: Prospective crossover study. ANIMALS: 37 adult male and female red-eared slider turtles (Trachemys scripta). PROCEDURES: Antinociception (n = 27 turtles) and respiratory (10 turtles) experiments were performed. Infrared heat stimuli were applied to the plantar surface of turtle limbs. Thermal withdrawal latencies were measured before and at intervals after SC administration of physiologic saline (0.9% NaCl) solution, butorphanol tartrate (2.8 or 28 mg/kg [1.27 or 12.7 mg/lb]), or morphine sulfate (1.5 or 6.5 mg/kg [0.68 or 2.95 mg/lb]). Ventilation was assessed in freely swimming turtles before and after SC administration of saline solution, butorphanol (28 mg/kg), or morphine (1.5 mg/kg). RESULTS: For as long as 24 hours after injection of saline solution or either dose of butorphanol, thermal withdrawal latencies among turtles did not differ. Low- and high-dose morphine injections increased latencies significantly by 8 hours. Ventilation was not altered by saline solution administration, was temporarily depressed by 56% to 60% for 1 to 2 hours by butorphanol (28 mg/kg) administration, and was significantly depressed by a maximum of 83 +/- 9% at 3 hours after morphine (1.5 mg/kg) injection. Butorphanol and morphine depressed ventilation by decreasing breathing frequency. CONCLUSIONS AND CLINICAL RELEVANCE: Although widely used in reptile species, butorphanol may not provide adequate antinociception for invasive procedures and caused short-term respiratory depression in red-eared slider turtles. In contrast, morphine apparently provided antinociception but caused long-lasting respiratory depression.
Descriptors: reptiles, turtles, analgesic efficacy, respiratory effects, butorphanol, morphine, antinociception, respiratory depression.

Animal Models

Carroll, R. (2006). **Marine adaptation in reptiles: a model for the study of large scale patterns and processes of evolution**. *Journal of Vertebrate Paleontology* 26(3, Suppl. S): 48A. ISSN: 0272-4634.
Descriptors: reptiles, marine adaptation, processes of evolution, study, model, patterns, meeting abstract.
Notes: Meeting Information: 66th Annual Meeting of the Society of Vertebrate Paleontology, Ottawa, Canada; October 18 -21, 2006.

Crews, D. and M.C. Moore (2005). **Historical contributions of research on reptiles to behavioral neuroendocrinology.** *Hormones and Behavior* 48(4): 384-394. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Abstract: Some of the first experiments in behavioral endocrinology in the 1930s were conducted with lizards, but events led to a hiatus that lasted for 30 years. In the 1960s, research resumed using techniques current at the time, but it was not until the mid-1970s that behavioral neuroendocrinology "discovered" reptiles as animal model systems. This historical review summarizes this period of work, illustrating an enormous increase in research that have led to conclusions such as (1) the phenomenon of dissociated reproductive strategies and hormone-independent behaviors, which have aided our understanding of how the "memory" of sex steroid actions is maintained. (2) Progesterone plays an important role in the organization and activation of sexual behavior in males. Progesterone also synergizes with T to control male courtship much as does estrogen and progesterone to control sexual receptivity in females. Thus, progesterone is as much a "male" hormone as it is a "female" hormone. (3) Use of cytochrome oxidase histochemistry to study the role of experience over the long term in modifying brain activity. (4) Hormone manipulations as a powerful tool to test hypotheses about the evolution of behavior in free-living animals.
Descriptors: lizards, aggression, behavior, neuroendocrinology, reptiles, physiology, gonadal steroid hormones, history, 20th century research, neuroendocrinology methods, reproduction physiology, sex factors, sexual behavior.

Daniels, C.B., B.C. Lewis, C. Tsopelas, S.L. Munns, S. Orgeig, M.E. Baldwin, S.A. Stacker, M.G. Achen, B.E. Chatterton, and R.D. Cooter (2003). **Regenerating lizard tails: A new model for investigating lymphangiogenesis.** *FASEB Journal* 17(3): 479-481. ISSN: print: 0892-6638; online: 1530-6860.
NAL Call Number: QH301.F3
Abstract: Impaired lymphatic drainage in human limbs causes the debilitating swelling termed lymphoedema. In mammals, known growth factors involved in the control of lymphangiogenesis (growth of new lymph vessels) are vascular endothelial growth factors-C and -D (VEGF-C/D). Here we characterize a model of lymphangiogenesis in which the tail of lizards is regenerated without becoming oedematous. Three weeks after the tail is shed (autotomy), there are a small number of large diameter lymphatic vessels in the regenerated

tail. Thereafter, the number increases and the diameter decreases. A functional lymphatic network, as determined by lymphoscintigraphy, is established 6 wk after autotomy. The new network differs morphologically and functionally from that in original tails. This lymphatic regeneration is associated with an up-regulation of a reptilian homologue of the VEGF-C/D protein family (rVEGF-C/D), as determined by Western blot analysis using a human reactive VEGF-C polyclonal antibody. Regenerating lizard tails are potentially useful models for studying the molecular basis of lymphangiogenesis with a view to developing possible treatments for human lymphoedema.

Descriptors: reptiles, lizard tails, regenerating, new model, investigating, lymphangiogenesis.

Lopez Garcia, C., A. Molowny, J. Nacher, X. Ponsoda, F. Sancho Bielsa, and G. Alonso Llosa (2002). **The lizard cerebral cortex as a model to study neuronal regeneration.** *Anais Da Academia Brasileira De Ciencias* 74(1): 85-104. ISSN: print: 0001-3765; online: 1678-2690.

Abstract: The medial cerebral cortex of lizards, an area homologous to the hippocampal fascia dentata, shows delayed postnatal neurogenesis, i.e., cells in the medial cortex ependyma proliferate and give rise to immature neurons, which migrate to the cell layer. There, recruited neurons differentiate and give rise to zinc containing axons directed to the rest of cortical areas, thus resulting in a continuous growth of the medial cortex and its zinc-enriched axonal projection. This happens along the lizard life span, even in adult lizards, thus allowing one of their most important characteristics: neuronal regeneration. Experiments in our laboratory have shown that chemical lesion of the medial cortex (affecting up to 95% of its neurons) results in a cascade of events: first, massive neuronal death and axonal-dendritic retraction and, secondly, triggered ependymal-neuroblast proliferation and subsequent neo-histogenesis and regeneration of an almost new medial cortex, indistinguishable from a normal undamaged one. This is the only case to our knowledge of the regeneration of an amniote central nervous centre by new neuron production and neo-histogenesis. Thus the lizard cerebral cortex is a good model to study neuronal regeneration and the complex factors that regulate its neurogenetic, migratory and neo-synaptogenetic events.

Descriptors: reptiles, lizards, cerebral cortex physiology, nerve regeneration, neurons physiology, cerebral cortex cytology, animal models.

Talent, L.G., J.N. Dumont, J.A. Bantle, D.M. Janz, and S.G. Talent (2002). **Evaluation of western fence lizards (*Sceloporus occidentalis*) and eastern fence lizards (*Sceloporus undulatus*) as laboratory reptile models for toxicological investigations.** *Environmental Toxicology and Chemistry* 21(5): 899-905. ISSN: 0730-7268.

NAL Call Number: QH545.A1E58

Abstract: A need is recognized for one or more laboratory reptile models for use in ecotoxicological studies and risk assessments. Maintenance of breeding populations of most reptile species under laboratory conditions is not practical because of their size and slow maturation rate. However, a number of species of spiny lizards (*Sceloporus* sp.) are small, mature quickly, and reproduce under laboratory conditions. We evaluated three populations of western fence lizards (*S. occidentalis*) and four populations of eastern fence lizards (*S. undulatus*) for their performance under laboratory conditions. We reared an F1 generation of each population

and compared their performance relative to survival, growth, maturation rate, and reproductive output. A population from the San Joaquin Valley (CA. USA) performed especially well under laboratory conditions and is a good candidate for a laboratory model. We also examined the sensitivity of developing fence lizard embryos to an estrogenic chemical to determine if male secondary sex characteristics were affected. Microinjecting eggs with an estrogenic chemical (17alpha-ethinylestradiol) feminized males and prevented development of embryonic secondary sex characteristics. Therefore, embryonic fence lizards may be useful for studying the effects of endocrine-disrupting chemicals.

Descriptors: reptiles, fence lizards, *Sceloporus occidentalis*, *Sceloporus undulatus*, laboratory reptile models , toxicological investigations, pollution, evaluation, risk assessment, embryonic fence lizards.

Vallone, D., E. Frigato, C. Vernesi, A. Foa, N.S. Foulkes, and C. Bertolucci (2007). **Hypothermia modulates circadian clock gene expression in lizard peripheral tissues.** *American Journal of Physiology. Regulatory, Integrative and Comparative Physiology* 292(1): R160-R166. ISSN: print: 0363-6119; online: 1422-1490.

Online: http://dx.doi.org/10.1152/ajpregu.00370.2006

Abstract: The molecular mechanisms whereby the circadian clock responds to temperature changes are poorly understood. The ruin lizard *Podarcis sicula* has historically proven to be a valuable vertebrate model for exploring the influence of temperature on circadian physiology. It is an ectotherm that naturally experiences an impressive range of temperatures during the course of the year. However, no tools have been available to dissect the molecular basis of the clock in this organism. Here, we report the cloning of three lizard clock gene homologs (Period2, Cryptochrome1, and Clock) that have a close phylogenetic relationship with avian clock genes. These genes are expressed in many tissues and show a rhythmic expression profile at 29 degrees C in light-dark and constant darkness lighting conditions, with phases comparable to their mammalian and avian counterparts. Interestingly, we show that at low temperatures (6 degrees C), cycling clock gene expression is attenuated in peripheral clocks with a characteristic increase in basal expression levels. We speculate that this represents a conserved vertebrate clock gene response to low temperatures. Furthermore, these results bring new insight into the issue of whether circadian clock function is compatible with hypothermia.

Descriptors: reptiles, lizard, *Podarcis sicula*, circadian clock, hypothermia, modulates, gene expression, peripheral tissues, temperature changes.

Anoxia and Hypoxia

Bickler, P.E. and L.T. Buck (2007). **Hypoxia tolerance in reptiles, amphibians, and fishes: life with variable oxygen availability.** *Annual Review of Physiology* 69: 145-170. ISSN: 0066-4278.
Abstract: The ability of fishes, amphibians, and reptiles to survive extremes of oxygen availability derives from a core triad of adaptations: profound metabolic suppression, tolerance of ionic and pH disturbances, and mechanisms for avoiding free-radical injury during reoxygenation. For long-term anoxic survival, enhanced storage of glycogen in critical tissues is also necessary. The diversity of body morphologies and habitats and the utilization of dormancy have resulted in a broad array of adaptations to hypoxia in lower vertebrates. For example, the most anoxia-tolerant vertebrates, painted turtles and crucian carp, meet the challenge of variable oxygen in fundamentally different ways: Turtles undergo near-suspended animation, whereas carp remain active and responsive in the absence of oxygen. Although the mechanisms of survival in both of these cases include large stores of glycogen and drastically decreased metabolism, other mechanisms, such as regulation of ion channels in excitable membranes, are apparently divergent. Common themes in the regulatory adjustments to hypoxia involve control of metabolism and ion channel conductance by protein phosphorylation. Tolerance of decreased energy charge and accumulating anaerobic end products as well as enhanced antioxidant defenses and regenerative capacities are also key to hypoxia survival in lower vertebrates.
Descriptors: amphibians, reptiles, fishes, hypoxia tolerance, variable oxygen availability, adaptations, controlof metabolism, regenerative capacities.

Bobb, V.T. and D.C. Jackson (2005). **Effect of graded hypoxic and acidotic stress on contractile force of heart muscle from hypoxia-tolerant and hypoxia-intolerant turtles.** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 303(5): 345-353. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Descriptors: turtles, hypoxic, acidotic, stress, heart muscle, contractile force, hypoxia tolerant, intolerant, effect.

Crossley, D.A.I. and J. Altimiras (2005). **Cardiovascular development in embryos of the American alligator *Alligator mississippiensis*: effects of chronic and acute hypoxia.** *Journal of Experimental Biology* 208(1): 31-39. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01355
NAL Call Number: 442.8 B77
Descriptors: reptiles, *Alligator mississippiensis*, circulatory system, cardiovascular development, acute hypoxia, embryo cardiovascular development, effects of chronic hypoxia, American alligator, North America.

Davis, E.C. and D.C. Jackson (2007). **Lactate uptake by skeletal bone in anoxic turtles, *Trachemys scripta.*** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 146(3): 299-304. ISSN: 1095-6433.

Abstract: Previous studies have shown that freshwater turtle shells can accumulate lactate during periods of anoxic submergence. Our objective in this study was to determine lactate uptake in other parts of the turtle's skeleton. We measured lactate concentration of 7 skeletal elements and 4 shell samples of red-eared slider turtles, *Trachemys scripta*, in control animals (N=12) and in animals following submergence for 4-5 days in N(2)-equilibrated water at 10 degrees C (N=8). We also collected blood samples and measured blood pH, PCO(2), and PO(2), and plasma lactate. Contralateral bone samples from 6 control turtles were analyzed for % water and mineral composition; bone from the other 6 were equilibrated with lactate solution in vitro. Anoxic submergence resulted in a combined respiratory/non-respiratory (lactic) acidosis and plasma lactate of 45.6+/-2.5 mmol l(-1). Shell and skeletal lactates all increased significantly in the anoxic animals (30.1-43.9 mmol kg(-1)) with limb bones having the highest levels and skull the least. Skeletal samples equilibrated in lactate solution in vitro for 2 days accumulated lactate in similar fashion with limb bones, except for fibula, higher, and skull significantly less than other bones. We conclude that the entire skeleton of the red-eared slider, like its shell, sequesters lactate and contributes thereby to lactic acid buffering.

Descriptors: reptiles, anoxic turtles, anoxia metabolism, skeletal bone, lactic uptake, lactic acid metabolism, physiology, acidosis, shell, bone, lactic acid buffers.

Dinkelacker, S.A., J.P. Costanzo, and R.E.J. Lee (2005). **Anoxia tolerance and freeze tolerance in hatchling turtles.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 175(3): 209-217. ISSN: print: 0174-1578; online: 1432-136X.

NAL Call Number: QP33.J681

Abstract: Freezing survival in hatchling turtles may be limited by ischemic anoxia in frozen tissues and the associated accumulation of lactate and reactive oxygen species (ROS). To determine whether mechanisms for coping with anoxia are also important in freeze tolerance, we examined the association between capacities for freezing survival and anoxia tolerance in hatchlings of seven species of turtles. Tolerance to freezing (-2.5 degrees C) was high in *Emydoidea blandingii*, *Chrysemys picta*, *Terrapene ornata*, and *Malaclemys terrapin* and low in *Graptemys geographica*, *Chelydra serpentina*, and *Trachemys scripta*. Hatchlings survived in a N(2) atmosphere at 4 degrees C for periods ranging from 17 d (M. terrapin) to 50 d (G. geographica), but survival time was not associated with freeze tolerance. Lactate accumulated during both stresses, but plasma levels in frozen/thawed turtles were well below those found in anoxia-exposed animals. Activity of the antioxidant enzyme catalase in liver increased markedly with anoxia exposure in most species, but increased with freezing/thawing only in species with low freeze tolerance. Our results suggest that whereas oxygen deprivation occurs during somatic freezing, freeze tolerance is not limited by anoxia tolerance in hatchling turtles.

Descriptors: turtles, acclimatization, physiology, anoxia, catalase metabolism, freezing, lactates, blood, liver anatomy, histology, enzymology, organ size, oxidative stress.

Jackson, D.C., S.E. Taylor, V.S. Asare, D. Villarnovo, J.M. Gall, and S.A. Reese (2007). **Comparative shell buffering properties correlate with anoxia tolerance in freshwater turtles.** *American Journal of Physiology. Regulatory, Integrative and Comparative Physiology* 292(2): R1008-R1015. ISSN: print: 0363-6119; online: 1522-1490.
Online: http://dx.doi.org/10.1152/ajpregu.00519.2006
Abstract: Freshwater turtles as a group are more resistant to anoxia than other vertebrates, but some species, such as painted turtles, for reasons not fully understood, can remain anoxic at winter temperatures far longer than others. Because buffering of lactic acid by the shell of the painted turtle is crucial to its long-term anoxic survival, we have tested the hypothesis that previously described differences in anoxia tolerance of five species of North American freshwater turtles may be explained at least in part by differences in their shell composition and buffering capacity. All species tested have large mineralized shells. Shell comparisons included 1) total shell CO2 concentration, 2) volume of titrated acid required to hold incubating shell powder at pH 7.0 for 3 h (an indication of buffer release from shell), and 3) lactate concentration of shell samples incubated to equilibrium in a standard lactate solution. For each measurement, the more anoxia-tolerant species (painted turtle, *Chrysemys picta*; snapping turtle, *Chelydra serpentina*) had higher values than the less anoxia-tolerant species (musk turtle, *Sternotherus odoratus*; map turtle, *Graptemys geographica*; red-eared slider, *Trachemys scripta*). We suggest that greater concentrations of accessible CO2 (as carbonate or bicarbonate) in the more tolerant species enable these species, when acidotic, to release more buffer into the extracellular fluid and to take up more lactic acid into their shells. We conclude that the interspecific differences in shell composition and buffering can contribute to, but cannot explain fully, the variations observed in anoxia tolerance among freshwater turtles.
Descriptors: reptiles , freshwater turtles, shell buffering properties, anoxia tolerence, lactic acid, shell composition, mineralized shells, species comparison.

Jackson, D.C. and J. Liu (2002). **The importance of blood flow for lactate uptake into shells of anoxic turtles**. *FASEB Journal* 16(4): A425. ISSN: 0892-6638.
NAL Call Number: QH301.F3
Descriptors: reptiles, turtles, anoxic, lactate uptake, blood flow, importance, meeting.
Notes: Meeting Information: Annual Meeting of the Professional Research Scientists on Experimental Biology, New Orleans, Louisiana, USA; April 20-24, 2002.

Lutz, P.L. and S.L. Milton (2004). **Negotiating brain anoxia survival in the turtle.** *Journal of Experimental Biology* 207(Pt 18): 3141-3147. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01056
NAL Call Number: 442.8 B77
Abstract: The turtle brain's extraordinary ability to tolerate anoxia is based on constitutive and expressed factors. Constitutive factors that predispose for anoxia tolerance include enhanced levels of glycogen stores, increased densities of protective receptors, elevated antioxidant capacities and elevated heat shock protein. However, to survive an anoxic insult, three distinct phases must be negotiated successfully. (1) A coordinated downregulation of ATP demand processes to basal levels. This phase, which takes 1-2 h, includes a reduction in voltage-gated K(+) (Kv) channel transcription and a substantial increase in Hsp72 and Hsc73

levels. During this period, adenosine and K(ATP) channels mediate several key events including channel arrest initiation and a reduction in the release of excitatory amino acids (EAAs). (2) Long-term survival (days) at basal levels of ATP expenditure. Neuronal network integrity is preserved through the continued operation of core activities. These include periodic electrical activity, an increased release of GABA and a continued release of glutamate and dopamine. Adenosine and GABA modulate the glutamate release. There is a further increase in Hsc73, indicating a 'housekeeping' role for this protein during this period. (3) A rapid upregulation of neuronal processes when oxygen becomes available to restore full function, together with the activation of protection mechanisms against reperfusion-generated reactive oxygen species.

Descriptors: reptiles, turtle, anoxia metabolism, brain metabolism, oxygen metabolism, anoxia tolerance, glycogen stores.

Milton, S.L., G. Nayak, P.L. Lutz, and H.M. Prentice (2006). **Gene transcription of neuroglobin is upregulated by hypoxia and anoxia in the brain of the anoxia-tolerant turtle *Trachemys scripta*.** *Journal of Biomedical Science* 13(4): 509-514. ISSN: print: 1021-7770; online: 1423-0127.

NAL Call Number: R850.A1

Abstract: Neuroglobin is a heme protein expressed in the vertebrate brain in mammals, fishes, and birds. The physiological role of neuroglobin is not completely understood but possibilities include serving as an intracellular oxygen-carrier or oxygen-sensor, as a terminal oxidase to regenerate NAD(+) under anaerobic conditions, or involvement in NO or ROS metabolism. As the vertebrate nervous system is particularly sensitive to hypoxia, an intracellular protein that helps sustain cellular respiration would aid hypoxic survival. However, the regulation of Neuroglobin (Ngb) under conditions of varying oxygen is controversial. This study examines the regulation of Ngb in an anoxia-tolerant vertebrate under conditions of hypoxia and anoxia. The freshwater turtle *Trachemys scripta* can withstand complete anoxia for days, and adaptations that permit neuronal survival have been extensively examined. Turtle neuroglobin specific primers were employed in RT-PCR for determining the regulation of neuroglobin mRNA expression in turtles placed in normoxia, hypoxia (4 h), anoxia (1 and 4 h), and anoxia-reoxygenation. Whole brain expression of neuroglobin is strongly upregulated by hypoxia and post-anoxic-reoxygenation in *T. scripta*, with a lesser degree of upregulation at 1 and 4 h anoxia. Our data implicate neuroglobin in mediating brain anoxic survival.

Descriptors: anorexia tolerant turtle, *Trachemys scripta*, gene expression and regulation, hypoxia, nerve tissue proteins, neuroglobin, heme proteins, turtle genetics.

Milton, S.L. and H.M. Prentice (2007). **Beyond anoxia: The physiology of metabolic downregulation and recovery in the anoxia-tolerant turtle.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 147(2): 277-290. ISSN: 1095-6433.

Abstract: The freshwater turtle *Trachemys scripta* is among the most anoxia-tolerant of vertebrates, a true facultative anaerobe able to survive without oxygen for days at room temperature to weeks or months during winter hibernation. Our good friend and colleague Peter Lutz devoted nearly 25 years to the study of the physiology of anoxia tolerance in these and

other model organisms, promoting not just the basic science but also the idea that understanding the physiology and molecular mechanisms behind anoxia tolerance provides insights into critical survival pathways that may be applicable to the hypoxic/ischemic mammalian brain. Work by Peter and his colleagues focused on the factors which enable the turtle to enter a deep hypometabolic state, including decreases in ion flux ("channel arrest"), increases in inhibitory neuromodulators like adenosine and GABA, and the maintenance of low extracellular levels of excitatory compounds such as dopamine and glutamate. Our attention has recently turned to molecular mechanisms of anoxia tolerance, including the upregulation of such protective factors as heat shock proteins (Hsp72, Hsc73), the reversible downregulation of voltage gated potassium channels, and the modulation of MAP kinase pathways. In this review we discuss three phases of anoxia tolerance, including the initial metabolic downregulation over the first several hours, the long-term maintenance of neuronal function over days to weeks of anoxia, and finally recovery upon reoxygenation, with necessary defenses against reactive oxygen stress.

Descriptors: reptiles, freshwater turtle, *Trachemys scripta*, metabolic downregulation, anoxia tolerant turtle, anoxia tolerance physiology, molecular mechanisms, oxygen stress.

Overgaard, J., T. Wang, O.B. Nielsen, and H. Gesser (2005). **Extracellular determinants of cardiac contractility in the cold anoxic turtle.** *Physiological and Biochemical Zoology* 78(6): 976-995. ISSN: 1522-2152.

NAL Call Number: QL1.P52

Abstract: Painted turtles (*Chrysemys picta*) survive months of anoxic submergence, which is associated with large changes in the extracellular milieu where pH falls by 1, while extracellular K+, Ca++, and adrenaline levels all increase massively. While the effect of each of these changes in the extracellular environment on the heart has been previously characterized in isolation, little is known about their interactions and combined effects. Here we examine the isolated and combined effects of hyperkalemia, acidosis, hypercalcemia, high adrenergic stimulation, and anoxia on twitch force during isometric contractions in isolated ventricular strip preparations from turtles. Experiments were performed on turtles that had been previously acclimated to warm (25 degrees C), cold (5 degrees C), or cold anoxia (submerged in anoxic water at 5 degrees C). The differences between acclimation groups suggest that cold acclimation, but not anoxic acclimation per se, results in a downregulation of processes in the excitation-contraction coupling. Hyperkalemia (10 mmol L(-1) K+) exerted a strong negative inotropic effect and caused irregular contractions; the effect was most pronounced at low temperature (57%-97% reductions in twitch force). Anoxia reduced twitch force at both temperatures (14%-38%), while acidosis reduced force only at 5 degrees C (15%-50%). Adrenergic stimulation (10 micromol L(-1)) increased twitch force by 5%-19%, but increasing extracellular [Ca++] from 2 to 6 mmol L(-1) had only small effects. When all treatments were combined with anoxia, twitch force was higher at 5 degrees C than at 25 degrees C, whereas in normoxia twitch force was higher at 25 degrees C. We propose that hyperkalemia may account for a large part of the depressed cardiac contractility during long-term anoxic submergence.

Descriptors: painted turtles, *Chrysemys picta*, anoxic, cold, cardiac contractility, extracellular determinants, long term anoxic submergence.

Pamenter, M.E., M.D. Richards, and L.T. Buck (2007). **Anoxia-induced changes in reactive oxygen species and cyclic nucleotides in the painted turtle.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 177(4): 473-481. ISSN: print: 0174-1578; online: 1432-136X.

NAL Call Number: QP33.J681

Abstract: The Western painted turtle survives months without oxygen. A key adaptation is a coordinated reduction of cellular ATP production and utilization that may be signaled by changes in the concentrations of reactive oxygen species (ROS) and cyclic nucleotides (cAMP and cGMP). Little is known about the involvement of cyclic nucleotides in the turtle's metabolic arrest and ROS have not been previously measured in any facultative anaerobes. The present study was designed to measure changes in these second messengers in the anoxic turtle. ROS were measured in isolated turtle brain sheets during a 40-min normoxic to anoxic transition. Changes in cAMP and cGMP were determined in turtle brain, pectoralis muscle, heart and liver throughout 4 h of forced submergence at 20-22 degrees C. Turtle brain ROS production decreased 25% within 10 min of cyanide or N(2)-induced anoxia and returned to control levels upon reoxygenation. Inhibition of electron transfer from ubiquinol to complex III caused a smaller decrease in [ROS]. Conversely, inhibition of complex I increased [ROS] 15% above controls. In brain [cAMP] decreased 63%. In liver [cAMP] doubled after 2 h of anoxia before returning to control levels with prolonged anoxia. Conversely, skeletal muscle and heart [cAMP] remained unchanged; however, skeletal muscle [cGMP] became elevated sixfold after 4 h of submergence. In liver and heart [cGMP] rose 41 and 127%, respectively, after 2 h of anoxia. Brain [cGMP] did not change significantly during 4 h of submergence. We conclude that turtle brain ROS production occurs primarily between mitochondrial complexes I and III and decreases during anoxia. Also, cyclic nucleotide concentrations change in a manner suggestive of a role in metabolic suppression in the brain and a role in increasing liver glycogenolysis.

Descriptors: reptiles, anoxic induced changes, western painted turtle, cyclic nucleotides, reactive oxygen species, ATP production, brain.

Price, E.R., F.V. Paladino, K.P. Strohl, Santidrian T P, K. Klann, and J.R. Spotila (2007). **Respiration in neonate sea turtles.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 146(3): 422-428. ISSN: 1095-6433.

Abstract: The pattern and control of respiration is virtually unknown in hatchling sea turtles. Using incubator-raised turtles, we measured oxygen consumption, frequency, tidal volume, and minute volume for leatherback (*Dermochelys coriacea*) and olive ridley (*Lepidochelys olivacea*) turtle hatchlings for the first six days after pipping. In addition, we tested the hatchlings' response to hypercapnic, hyperoxic, and hypoxic challenges over this time period. Hatchling sea turtles generally showed resting ventilation characteristics that are similar to those of adults: a single breath followed by a long respiratory pause, slow frequency, and high metabolic rate. With hypercapnic challenge, both species responded primarily by elevating respiratory frequency via a decrease in the non-ventilatory period. Leatherback resting tidal volume increased with age but otherwise, neither species' resting respiratory pattern nor response to gas challenge changed significantly over the first few days after hatching. At the time of nest emergence, sea turtles have achieved a respiratory pattern that is similar to that

of actively diving adults.
Descriptors: reptiles, neonate sea turtles, leatherback, *Dermochelys coriacea*, olive ridley, *Lepidochelys olivacea*, respiration, pattern, control, hatchling, oxygen consumption, tidal volume.

Rial, R.V., M.C. Nicolau, A. Gamundi, T. Ortega, and M. Akaarir (2002). **Periodic breathing and apnoeas in reptiles**. *Journal of Sleep Research* 11(Suppl. 1): 191-192. ISSN: 0962-1105.
Descriptors: reptiles, periodic breathing, sleep apnea.
Notes: Meeting Information: 16th Congress of the European Sleep Research Society, Reykjavik, Iceland; June 3-7, 2002.

Stecyk, J.A. and A.P. Farrell (2007). **Effects of extracellular changes on spontaneous heart rate of normoxia- and anoxia-acclimated turtles (*Trachemys scripta*).** *Journal of Experimental Biology* 210(Pt 3): 421-431. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.02653
NAL Call Number: 442.8 B77
Abstract: Heart rate (f(H)) of the anoxia-tolerant freshwater turtle (*Trachemys scripta*) during prolonged anoxia exposure is 2.5- to 5-times lower than the normoxic rate, but whether alterations in blood composition that accompany prolonged anoxia contribute to this bradycardia is unknown. We examined how temperature acclimation, oxygen deprivation, acidosis, hyperkalemia, hypercalcemia and adrenaline affect chronotropy in the turtle myocardium. We monitored spontaneous contraction rates of right-atrial preparations obtained from 21 degrees C- and 5 degrees C-acclimated turtles that had been exposed to either normoxia or anoxia (6 h at 21 degrees C; 2 weeks at 5 degrees C). Sequential exposures to saline solutions were designed to mimic, in a step-wise manner, the shift from a normoxic to anoxic extracellular condition (for normoxia-acclimated preparations) or the reverse (for anoxia-acclimated preparations). Our results clearly show that prolonged anoxia exposure re-sets the intrinsic f(H) of turtles at both temperatures, with reductions in intrinsic f(H) in the range of 25%-53% compared with normoxia. This intrinsic change would contribute to the bradycardia observed with prolonged anoxia. Further, we found negative chronotropic effects of extracellular anoxia, acidosis and hyperkalemia, and positive chronotropic effects of hypercalcemia and adrenaline. The exact nature of these extracellular effects depended, however, on the acclimation temperature and the prior exposure of the animal to anoxia. With normoxia-acclimated preparations at 21 degrees C, combined anoxia and acidosis (pH reduced from approximately 7.8 to approximately 7.2) significantly reduced spontaneous f(H) by 22% and subsequent exposure to hyperkalemia (3.5 mmol l(-1)K(+)) further decreased f(H). These negative chronotropic effects were ameliorated by increasing the adrenaline concentration from the tonic level of 1 nmol l(-1) to 60 nmol l(-1). However, in anoxia-acclimated preparations at 21 degrees C, anoxia alone inhibited f(H) (by approximately 30%). This negative chronotropic effect was counteracted by both hypercalcemia (6 mmol l(-1) Ca(2+)) and adrenaline (60 nmol l(-1)). At 5 degrees C, only the combination of anoxia, acidosis (pH reduced from approximately 8.0 to approximately 7.5) and hyperkalemia (3.5 mmol l(-1) K(+)) significantly reduced spontaneous f(H) (by 23%) with preparations from normoxia-acclimated turtles. This negative chronotropic effect was fully reversed by hypercalcemia (10 mmol l(-1) Ca(2+)). By contrast, spontaneous f(H) of anoxia-acclimated preparations at 5

degrees C was not affected by any of the extracellular changes. We conclude that prior temperature and anoxia experiences are central to determining f(H) during prolonged anoxia in *Trachemys scripta* both as a result of the re-setting of pacemaker rhythm and through the potential influence of extracellular changes.
Descriptors: reptiles, freshwater turtle, *Trachemys scripta*, extracellular changes, effect, spontaneous heart rate, normoxia, anoxia, bradycardia.

Storey, K.B. (2007). **Anoxia tolerance in turtles: Metabolic regulation and gene expression.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 147(2): 263-276. ISSN: 1095-6433.
Abstract: Freshwater turtles of the *Trachemys* and *Chrysemys* genera are champion facultative anaerobes able to survive for several months without oxygen during winter hibernation in cold water. They have been widely used as models to identify and understand the molecular mechanisms of natural anoxia tolerance and the molecular basis of the hypoxic/ischemic injuries that occur in oxygen-sensitive systems and underlie medical problems such as heart attack and stroke. Peter L. Lutz spent much of his career investigating turtle anaerobiosis with a particular focus on the mechanisms of brain ion homeostasis and neurotransmitter responses to anoxia exposure and the mechanisms that suppress brain ion channel function and neuronal excitability during anaerobiosis. Our interests intersected over the mechanisms of metabolic rate depression which is key to long term anoxia survival. Studies in my lab have shown that a key mechanism of metabolic arrest is reversible protein phosphorylation which provides coordinated suppression of the rates of multiple ATP-producing, ATP-utilizing and related cellular processes to allow organisms to enter a stable hypometabolic state. Anoxia tolerance is also supported by selective gene expression as revealed by recent studies using cDNA library and DNA array screening. New studies with both adult *T. scripta elegans* and hatchling *C. picta marginata* have identified prominent groups of genes that are up-regulated under anoxia in turtle organs, in several cases suggesting aspects of cell function and metabolic regulation that have not previously been associated with anaerobiosis. These groups of anoxia-responsive genes include mitochondrially-encoded subunits of electron transport chain proteins, iron storage proteins, antioxidant enzymes, serine protease inhibitors, transmembrane solute carriers, neurotransmitter receptors and transporters, and shock proteins.
Descriptors: reptiles, turtles, *T. scripta elegans*, *C. picta marginata*, anoxia tolerence, metabolic regulation, gene expression, anaerobes, winter, cold, hibernation, anoxia responsive genes.

Storey, K.B. (2003). **Anoxia and hypoxia: oysters, turtles and beyond.** *SICB Annual Meeting and Exhibition Final Program and Abstracts* 2003: 315-316. ISSN: print: 1540-7063; online: 1557-7023.
Descriptors: reptiles, turtles, anoxia, hypoxia, oysters, meeting abstracts.
Notes: Meeting Information: Annual Meeting and Exhibition of the SICB (Society for Integrative and Comparative Biology), Toronto, ON, Canada; January 4-8, 2003.

Toney, V.I. and D.C. Jackson (2003). **Cardiovascular effects of graded hypoxia and graded acidosis on the myocardium of the western painted turtle.** *FASEB Journal* 17(4-5): Abstract No. 313.5. ISSN: 0892-6638.
NAL Call Number: QH301.F3
Descriptors: reptiles, painted turtle, graded hypoxia, acidosis myocardium, cardiovascular, effects, meeting.
Notes: Meeting Information: FASEB Meeting on Experimental Biology: Translating the Genome, San Diego, CA, USA; April 11-15, 2003.

Toney, V.I. and D.C. Jackson (2002). **Cardiovascular effects of graded hypoxia on the myocardium of the western painted turtle**. *FASEB Journal* 16(5): A887. ISSN: 0892-6638.
NAL Call Number: QH301.F3
Descriptors: reptiles, painted turtle, graded hypoxia, effects, myocardium, cardiovascular, effects, meeting abstracts.
Notes: Meeting Information: Annual Meeting of Professional Research Scientists on Experimental Biology, New Orleans, Louisiana, USA; April 20-24, 2002.

Warren, D.E., S.A. Reese, and D.C. Jackson (2006). **Tissue glycogen and extracellular buffering limit the survival of red-eared slider turtles during anoxic submergence at 3 degrees C.** *Physiological and Biochemical Zoology* 79(4): 736-744. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: The goal of this study was to identify the factors that limit the survival of the red-eared slider turtle *Trachemys scripta* during long-term anoxic submergence at 3 degrees C. We measured blood acid-base status and tissue lactate and glycogen contents after 13, 29, and 44 d of submergence from ventricle, liver, carapace (lactate only), and four skeletal muscles. We also measured plasma Ca(2+), Mg(2+), Na(+), K(+), Cl(-), inorganic phosphate (P(i)), lactate, and glucose. After 44 d, one of the six remaining turtles died, while the other turtles were in poor condition and suffered from a severe acidemia (blood pH = 7.09 from 7.77) caused by lactic acidosis (plasma lactate 91.5 mmol L(-1)). An initial respiratory acidosis attenuated after 28 d. Lactate rose to similar concentrations in ventricle and skeletal muscle (39.3-46.1 micromol g(-1)). Liver accumulated the least lactate (21.8 micromol g(-1)), and carapace accumulated the most lactate (68.9 micromol g(-1)). Plasma Ca(2+) and Mg(2+) increased significantly throughout submergence to levels comparable to painted turtles at a similar estimated lactate load. Glycogen depletion was extensive in all tissues tested: by 83% in liver, by 90% in ventricle, and by 62%-88% in muscle. We estimate that the shell buffered 69.1% of the total lactate load, which is comparable to painted turtles. Compared with painted turtles, predive tissue glycogen contents and plasma HCO(-)(3) concentrations were low. We believe these differences contribute to the poorer tolerance to long-term anoxic submergence in red-eared slider turtles compared with painted turtles.
Descriptors: reptiles, painted turtles, red-eared slider turtle, *Trachemys scripta*, anoxic submergence, 3 degrees centigrade, tissue glycogen, extracellular buffering, survival.

Behavior

Anonymous (2004). **Growing interest in reptile behaviour.** *Veterinary Record* 154(16): 485-486. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, animal husbandry, behavior, animal.

Anonymous (2004). **Managing reptile behaviour.** *Journal of Small Animal Practice.* 45(6): 330. ISSN: print: 0022-4510; online: 1748-5827.
NAL Call Number: 41.8 J8292
Descriptors: reptiles, animal husbandry, behavior, captivity, care.

Belliure, J. and J. Clobert (2004). **Behavioral sensitivity to corticosterone in juveniles of the wall lizard, *Podarcis muralis*.** *Physiology and Behavior* 81(1): 121-127. ISSN: 0031-9384.
Abstract: Reptiles exposed to stressful conditions respond with increases in plasma levels of corticosterone (CORT). The outcome of such hormonal fluctuations can affect the organism's physiology and behavior; however, relatively few studies in reptiles have progressed past the effects of stress on the plasma levels of CORT. The purpose of this study was to investigate the effects of CORT on lizard behavior. We focused on activity and thermoregulation of juveniles of the wall lizard, *Podarcis muralis*. Juveniles with experimentally elevated plasma CORT concentrations showed a higher moving rate and spent a greater amount of time moving. They also spent more time being involved in attempts to escape from a terrarium. This enhanced locomotor activity was associated with significant changes in thermoregulatory behavior, as CORT-increased individuals had reduced thermoregulatory activity than the controls. The same pattern of results was obtained in nature and under laboratory conditions. Thus, CORT levels appear to mediate an important trade-off between locomotor activity and thermoregulation. To our knowledge, this is the first time that the effect of CORT on lizard thermoregulation has been examined.
Descriptors: reptiles, wall lizard, *Podarcis muralis*, juveniles, corticosterone, behavioral sensitivity, stressful conditions, plasma levels.

Bradshaw, C.J., C.R. McMahon, and G.C. Hays (2007). **Behavioral inference of diving metabolic rate in free-ranging leatherback turtles.** *Physiological and Biochemical Zoology* 80(2): 209-219. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Good estimates of metabolic rate in free-ranging animals are essential for understanding behavior, distribution, and abundance. For the critically endangered leatherback turtle (*Dermochelys coriacea*), one of the world's largest reptiles, there has been a long-standing debate over whether this species demonstrates any metabolic endothermy. In short, do leatherbacks have a purely ectothermic reptilian metabolic rate or one that is elevated as a result of regional endothermy? Recent measurements have provided the first estimates of field metabolic rate (FMR) in leatherback turtles using doubly labeled water; however, the

technique is prohibitively expensive and logistically difficult and produces estimates that are highly variable across individuals in this species. We therefore examined dive duration and depth data collected for nine free-swimming leatherback turtles over long periods (up to 431 d) to infer aerobic dive limits (ADLs) based on the asymptotic increase in maximum dive duration with depth. From this index of ADL and the known mass-specific oxygen storage capacity (To(2)) of leatherbacks, we inferred diving metabolic rate (DMR) as To2/ADL. We predicted that if leatherbacks conform to the purely ectothermic reptilian model of oxygen consumption, these inferred estimates of DMR should fall between predicted and measured values of reptilian resting and field metabolic rates, as well as being substantially lower than the FMR predicted for an endotherm of equivalent mass. Indeed, our behaviorally derived DMR estimates (mean=0.73+/-0.11 mL O(2) min(-1) kg(-1)) were 3.00+/-0.54 times the resting metabolic rate measured in unrestrained leatherbacks and 0.50+/-0.08 times the average FMR for a reptile of equivalent mass. These DMRs were also nearly one order of magnitude lower than the FMR predicted for an endotherm of equivalent mass. Thus, our findings lend support to the notion that diving leatherback turtles are indeed ectothermic and do not demonstrate elevated metabolic rates that might be expected due to regional endothermy. Their capacity to have a warm body core even in cold water therefore seems to derive from their large size, heat exchangers, thermal inertia, and insulating fat layers and not from an elevated metabolic rate.
Descriptors: reptiles, leatherback turtles, diving metabolic rate, behavioral inference, metabolic rate, ectothermic, warm body core.

Fox, S.F., J.K. McCoy and T.A. Baird (Editors) (2003). ***Lizard Social Behavior***, Johns Hopkins University Press: Baltimore, MD, 438 p. ISBN: 0801868939.
NAL Call Number: QL666.L2 L59 2003
Descriptors: reptiles, lizards, social behavior in animals.

Gao, Z.f. (2005). **Observation on behavior and reproduction of some reptiles under artificial breeding condition.** *Sichuan Journal of Zoology* 24(2): 180. ISSN: 1000-7083.
Descriptors: reptiles, reproduction, observation, artificial breeding condition, behavior.
Language of Text: Chinese.

Gregory, P.T. and L.a. Gregory (2006). **Immobility and supination in garter snakes (*Thamnophis elegans*) following handling by human predators**. *Journal of Comparative Psychology* 120(3): 262-268. ISSN: 0735-7036.
Descriptors: reptiles, garter snakes, *Thamnophis elegans*, immobility, following handling, human predators, physical restraint, response.

Hoglund, E., W.J. Korzan, M.J. Watt, G.L. Forster, T.R. Summers, H.F. Johannessen, K.J. Renner, and C.H. Summers (2005). **Effects of L-DOPA on aggressive behavior and central monoaminergic activity in the lizard *Anolis carolinensis*, using a new method for drug delivery.** *Behavioural Brain Research* 156(1): 53-64. ISSN: 0166-4328.
Abstract: The dopamine (DA) precursor, L-DOPA (500 microg), was injected into living crickets, which were ingested (one each) by adult male *Anolis carolinensis*. This method of

delivery elevated plasma L-DOPA and DA concentrations by approximately 1000-fold. In contrast, plasma epinephrine (Epi) and norepinephrine (NE) were not influenced by L-DOPA treatment, although they were elevated following the consumption of the cricket. Lizards that ingested L-DOPA treated crickets had elevated L-DOPA in all brain regions measured, with DA and/or DOPAC also increased significantly in most brain regions studied. Despite increased DA levels in the striatum and nucleus accumbens as a response to L-DOPA, the treatment had no influence on general motor activity. Central serotonin, NE, and Epi systems were not affected in any brain region by oral L-DOPA treatment. In addition, aggression was inhibited by this dose of L-DOPA, even though there was no effect on serotonergic systems. This is surprising because controlling aggressive behavior is usually considered the province of serotonergic activity. Aggression was measured before and after treatment, and while saline-treated lizards retained the full vigor of aggressive activity, those fed a cricket injected with L-DOPA were only one-third as aggressive after treatment. As L-DOPA treatment did not affect general motor activity, the effect appears to be directly associated with aggression. This is supported by the observation that L-DOPA treatment delayed latency to eyespot darkening, which predicts the latency to aggression.
Descriptors: lizard, *Anolis carolinensis*, behavior, L-DOPA, agressive behavior, central monoaminergic activity, drug delivery method, crickets, dopamine.

Irwin, W.P. and K.J. Lohmann (2005). **Disruption of magnetic orientation in hatchling loggerhead sea turtles by pulsed magnetic fields.** *Journal of Comparative Physiology. A, Neuroethology, Sensory, Neural, and Behavioral Physiology* 191(5): 475-480. ISSN: 0340-7594.
NAL Call Number: QP33.J68
Abstract: Loggerhead sea turtles (*Caretta caretta*) derive both directional and positional information from the Earth's magnetic field, but the mechanism underlying magnetic field detection in turtles has not been determined. One hypothesis is that crystals of biogenic, single-domain magnetite provide the physical basis of the magnetic sense. As a first step toward determining if magnetite is involved in sea turtle magnetoreception, hatchling loggerheads were exposed to pulsed magnetic fields (40 mT, 4 ms rise time) capable of altering the magnetic dipole moment of biogenic magnetite crystals. A control group of turtles was treated identically but not exposed to the pulsed fields. Both groups of turtles subsequently oriented toward a light source, implying that the pulsed fields did not disrupt the motivation to swim or the ability to maintain a consistent heading. However, when swimming in darkness under conditions in which turtles normally orient magnetically, control turtles oriented significantly toward the offshore migratory direction while those that were exposed to the magnetic pulses did not. These results are consistent with the hypothesis that at least part of the sea turtle magnetoreception system is based on magnetite. In principle, a magnetite-based magnetoreception system might be involved in detecting directional information, positional information, or both.
Descriptors: loggerhead sea turtles, *Caretta caretta*, electromagnetic fields, magnetic disruption, orientation, turtle physiology, pulsed magnetic fields.

James, M.C., R.A. Myers, and C.A. Ottensmeyer (2005). **Behaviour of leatherback sea turtles, *Dermochelys coriacea*, during the migratory cycle.** *Proceedings of the Royal Society. Biological Sciences. Series B* 272(1572): 1547-1555. ISSN: 0962-8452.
NAL Call Number: 501 L84B
Descriptors: reptiles, leatherback sea turtle, *Dermochelys coriacea*, aquatic diving, behavior during migratory cycle.

Kabelik, D., S.L. Weiss, and M.C. Moore (2006). **Steroid hormone mediation of limbic brain plasticity and aggression in free-living tree lizards, *Urosaurus ornatus*.** *Hormones and Behavior* 49(5): 587-597. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Abstract: The neural mechanisms by which steroid hormones regulate aggression are unclear. Although testosterone and its metabolites are involved in both the regulation of aggression and the maintenance of neural morphology, it is unknown whether these changes are functionally related. We addressed the hypothesis that parallel changes in steroid levels and brain volumes are involved in the regulation of adult aggression. We examined the relationships between seasonal hormone changes, aggressive behavior, and the volumes of limbic brain regions in free-living male and female tree lizards (*Urosaurus ornatus*). The brain nuclei that we examined included the lateral septum (LS), preoptic area (POA), amygdala (AMY), and ventromedial hypothalamus (VMH). We showed that the volumes of the POA and AMY in males and the POA in females vary with season. However, reproductive state (and thus hormonal state) was incompletely predictive of these seasonal changes in males and completely unrelated to changes in females. We also detected male-biased dimorphisms in volume of the POA, AMY, and a dorsolateral subnucleus of the VMH but did not detect a dimorphism between alternate male morphological phenotypes. Finally, we showed that circulating testosterone levels were higher in males exhibiting higher frequency and intensity of aggressive display to a conspecific, though brain nucleus volumes were unrelated to behavior. Our findings fail to support our hypothesis and suggest instead that plasma testosterone level covaries with aggression level and in a limited capacity with brain nucleus volumes but that these are largely unrelated relationships.
Descriptors: reptiles, free living tree lizards, *Urosaurus ornatus*, steroid hormonelimbic brain plasticity, aggression, testosterone.
Notes: Comment In: Horm Behav. 2006 May;49(5):577-9.

Lappin, A.K. and M. German (2005). **Feeding behavior modulation in the leopard lizard (*Gambelia wislizenii*): Effects of noxious versus innocuous prey.** *Zoology [Jena]* 108(4): 287-295. ISSN: 0944-2006.
NAL Call Number: QL1.Z769
Abstract: Feeding, a fundamentally rhythmic behavior in many animals, is expected to exhibit modulation with respect to prey type. Using high-speed videography (200 frames(-1)) and kinematic analysis, we investigated prey-processing behavior in the long-nosed leopard lizard (*Gambelia wislizenii*). The effects of two prey types were examined, innocuous immature crickets (*Acheta domesticus*) and noxious stinging hymenopterans (honeybees [*Apis mellifer*] and yellow jackets [Vespula sp.]). Stinging hymenopterans are processed more

extensively, with higher gape-cycling frequencies, and for a greater duration than are crickets. Generalized tetrapod feeding models were used as a framework to test the hypothesis that gape profile characteristics are modulated in response to prey noxiousness. Cricket processing generally fits the models, but hymenopteran processing departs from typical model parameters. In particular, the SO phase is absent to barely detectable during hymenopteran processing. This likely represents an effect of extrinsic neural input on a centrally directed rhythmic motor pattern, possibly to avoid being stung. Differences in the capture behavior of crickets versus hymenopterans indicate that *G. wislizenii* assesses prey noxiousness before physical contact with prey and modifies its capture behavior accordingly. These results add to the growing body of evidence that sensory information can play a critical role in shaping stereotyped rhythmic behaviors in non-mammalian tetrapods.
Descriptors: long-nosed leopard lizard (*Gambelia wislizenii*), feeding behavior, lizards physiology, modulation, prey type, innocuous prey, noxious prey.

LeMaster, M.P. and R.T. Mason (2002). **Variation in a female sexual attractiveness pheromone controls male mate choice in garter snakes.** *Journal of Chemical Ecology* 28(6): 1269-1285. ISSN: print: 0098-0331; online: 1573-1561.
Abstract: Male red-sided garter snakes (*Thamnophis sirtalis parietalis*) display a courtship preference for larger females during the breeding season. Utilizing behavioral experiments and chemical analyses, we tested the hypothesis that males can discriminate among females of varying size solely by means of the sexual attractiveness pheromone, a previously characterized sex pheromone composed of a homologous series of long-chain saturated and omega-9 cis-unsaturated methyl ketones contained in the skin lipids of females. When presented with skin lipid extracts from large and small females, a greater proportion of males displayed courtship behaviors to large female extracts. This demonstrates that there is an intrinsic property of the female skin lipids that allows males to differentiate among large and small females. Analysis of the sexual attractiveness pheromone revealed that the necessary variation exists for this pheromone to function as a reliable indicator to males of female body size. Specifically, we observed a strong correlation between female snout-vent length and the relative concentration of saturated and omega-9 cis-unsaturated methyl ketones composing the pheromone; smaller females expressed pheromone profiles higher in saturated methyl ketones. while larger females expressed pheromone profiles dominated by unsaturated methyl ketones. The results of this study suggest that male red-sided garter snakes utilize compositional variation in the female sexual attractiveness pheromone to differentiate among potential mates of varying size.
Descriptors: reptiles, garter snakes, *Thamnophis sirtalis parietalis*, female sexual attractiveness, variation, pheromone controls, mate choice, preference for larger females.

Loehr, V.J.T. (2006). **Captive husbandry of the dwarf plated lizard, *Cordylosaurus subtessellatus* (Smith, 1844), with indications for ecological and behavioural characteristics**. *Herpetological Bulletin* (96): 5-11. ISSN: 1473-0928.
Descriptors: reptiles, dwarf plated lizard, *Cordylosaurus subtessellatus*, captive husbandry, behavioral characteristics, activity pattern, mating.

Lutterschmidt, D.I., W.I. Lutterschmidt, N.B. Ford, and V.H. Hutchison (2002). **Behavioral thermoregulation and the role of melatonin in a nocturnal snake.** *Hormones and Behavior* 41(1): 41-50. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Abstract: Daily and seasonal variations in hormone levels influence the complex interactions between behavior and physiology. Ectothermic animals possess the unique ability behaviorally to adjust body temperature (T(b)) to control physiological rate processes. Thus, a hormone may indirectly influence a physiological rate by directly influencing the behaviors that adjust or control that rate process. Although many hormonal influences on behavioral regulation of T(b) remain uninvestigated, melatonin (MEL) generally is considered a hormone that decreases mean preferred T(b). Many ectotherms demonstrate the selection of lower T(b)'s in response to increased MEL concentrations. Here, we examined the influence of MEL on the behavioral regulation of T(b) in the nocturnal African house snake *Lamprophis fuliginosus*. A series of experiments with two injection regimes of MEL had no significant effect on the mean preferred T(b) of *L. fuliginosus*. In addition, mean preferred T(b)'s during the photophase did not differ significantly from those during scotophase. Our findings suggest that *L. fuliginosus* does not respond to elevated concentrations of either endogenous or exogenous MEL. To verify that the African house snake is nocturnal, we investigated activity patterns of *L. fuliginosus* throughout the photoperiod. The activity period of *L. fuliginosus* occurs in the scotophase of the photoperiod, a pattern consistent with that of nocturnal species. This suggests that nocturnal organisms such as *L. fuliginosus* may not respond to MEL in the same manner as many diurnal species. Our results support the hypothesis that some animals, particularly nocturnal species, may have developed alternative responses to increased plasma concentrations of MEL.
Descriptors: reptiles, nocturnal snake, *Lamprophis fuliginosus*, behavioral thermoregulation, role of melatonin, body temperature.

McMann, S. and A.V. Paterson (2003). **Effects of capture, observer presence, and captivity on display behavior in a lizard.** *Journal of Herpetology* 37(3): 538-540. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: reptiles, lizard, behavior, captivity, display, observer presence, capture, effects.

Powell, R. (2006). **Lizard warfare.** *Iguana* 13(1): 22-23. ISSN: 1554-916X.
Descriptors: reptiles, lizard, warfare, fighting behavior.

Rubenstein, D.R. and M. Wikelski (2005). **Steroid hormones and aggression in female Galapagos marine iguanas.** *Hormones and Behavior* 48(3): 329-341. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Descriptors: reptiles, Galapagos marine iguanas, steroid hormones, aggression, female.

Sale, A., P. Luschi, R. Mencacci, P. Lambardi, G.R. Hughes, G.C. Hays, S. Benvenuti, and F. Papi (2006). **Long-term monitoring of leatherback turtle diving behaviour during oceanic movements.** *Journal of Experimental Marine Biology and Ecology* 328(2): 197-210 . ISSN: 0022-0981.

Descriptors: reptiles, leatherback turtle, *Dermochelys coriacea*, diving behavior, oceanic movements, long term monitoring.

Seebacher, F., C.E. Franklin, and M. Read (2005). **Diving behaviour of a reptile (*Crocodylus johnstoni*) in the wild: interactions with heart rate and body temperature.** *Physiological and Biochemical Zoology* 78(1): 1-8. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: The differences in physical properties of air and water pose unique behavioural and physiological demands on semiaquatic animals. The aim of this study was to describe the diving behaviour of the freshwater crocodile *Crocodylus johnstoni* in the wild and to assess the relationships between diving, body temperature, and heart rate. Time-depth recorders, temperature-sensitive radio transmitters, and heart rate transmitters were deployed on each of six *C. johnstoni* (4.0-26.5 kg), and data were obtained from five animals. Crocodiles showed the greatest diving activity in the morning (0600-1200 hours) and were least active at night, remaining at the water surface. Surprisingly, activity pattern was asynchronous with thermoregulation, and activity was correlated to light rather than to body temperature. Nonetheless, crocodiles thermoregulated and showed a typical heart rate hysteresis pattern (heart rate during heating greater than heart rate during cooling) in response to heating and cooling. Additionally, dive length decreased with increasing body temperature. Maximum diving length was 119.6 min, but the greatest proportion of diving time was spent on relatively short (<45 min) and shallow (<0.4 m) dives. A bradycardia was observed during diving, although heart rate during submergence was only 12% lower than when animals were at the surface.
Descriptors: alligators, crocodiles, *Crocodylus johnstoni*, physiology, body temperature regulation, diving physiology, heart rate, diving behavior, activity pattern, air, water, physical properties.

Somma, L.A. (2003). **A few more additions to the literature on parental behavior in lizards and snakes.** *Bulletin of the Chicago Herpetological Society* 38(11): 217-220. ISSN: 0009-3564.
Descriptors: reptiles, parental behavior, lizards, snakes, literature.

Somma, L.A. (2003). ***Parental Behavior in Lepidosaurian and Testudinian Reptiles: A Literature Survey.***, Krieger Publishing Company: Malabar, Florida, 174 p. ISBN: 157524201X.
Descriptors: reptiles, lepidosauria, testudinian, literature survey, parental behavior.

Wade, J. (2005). **Current research on the behavioral neuroendocrinology of reptiles.** *Hormones and Behavior* 48(4): 451-460. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Abstract: Selected reptilian species have been the targets of investigations in behavioral neuroendocrinology for many years. Reptiles offer a particularly powerful set of traits that facilitate comparisons at multiple levels, including those within and between individuals of a particular species, between different environmental and social contexts, as well as across species. These types of studies, particularly as they are considered within the framework of results from other vertebrates, will enhance our understanding of the genetic and hormonal

influences regulating changes in the structure and function of the nervous system. Work on the hormonal and environmental factors influencing courtship and copulatory behaviors in green anoles, including the development and maintenance of the neuromuscular structures critical for their display, is highlighted. Some very recent work on other model systems is also discussed to provide a context for suggested future research directions.
Descriptors: reptiles, behavior, physiology, neurosecretory systems, physiology, reproduction physiology, sexual behavior, gonadal steroid hormones.

Wassersug, R.J., L. Roberts, J. Gimian, E. Hughes, R. Saunders, D. Devison, J. Woodbury, and J.C. O'Reilly (2005). **The behavioral responses of amphibians and reptiles to microgravity on parabolic flights.** *Zoology [Jena]* 108(2): 107-120. ISSN: 0944-2006.
NAL Call Number: QL1.Z769
Abstract: In the present study, we exposed 53 animals from 23 different species of amphibians and reptiles to microgravity (mug). This nearly doubles the number of amphibians and reptiles observed so far in mug. The animals were flown on a parabolic flight, which provided 20-25s of mug, to better characterize behavioral reactions to abrupt exposure to mug. Highly fossorial limbless caecilians and amphisbaenians showed relatively limited movement in mug. Limbed quadrupedal reptiles that were non-arboreal in the genera Leiocephalus, Anolis, and Scincella showed the typical righting response and enormous amounts of body motion and tail rotation, which we interpreted as both righting responses and futile actions to grasp the substrate. Both arboreal and non-arboreal geckos in the genera Uroplatus, Palmatogecko, Stenodactylus, Tarentola, and Eublepharis instead showed a skydiving posture previously reported for highly arboreal anurans. Some snakes, in the genera Thamnophis and Elaphe, which typically thrashed and rolled in mug, managed to knot their own bodies with their tails and immediately became quiescent. This suggests that these reptiles gave stable physical contact, which would indicate that they were not falling, primacy over vestibular input that indicated that they were in freefall. The fact that they became quiet upon self-embrace further suggests a failure to distinguish self from non-self. The patterns of behavior seen in amphibians and reptiles in mug can be explained in light of their normal ecology and taxonomic relations.
Descriptors: various species of reptiles and amphibians, gravity perception, physiology, hypogravity, motor activity, microgravity (mug), behavioral reactions.

Waterloo, B. and M.K. Bayless (2006). **Notes on the breeding behaviour of the crocodile monitor (*Varanus salvadorii*) in captivity**. *Herpetological Bulletin*(98): 2-6. ISSN: 1473-0928.
Descriptors: reptiles, crocodile monitor, captive, *Varanus salvadorii*, breeding behavior, notes , husbandry, care.

Weiss, S.L. and M.C. Moore (2004). **Activation of aggressive behavior by progesterone and testosterone in male tree lizards, *Urosaurus ornatus*.** *General and Comparative Endocrinology* 136(2): 282-288. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: Testosterone is usually thought to be the major sex steroid regulating adult male territorial aggression in vertebrates. However, recent evidence has suggested a role for proges-

terone, as well as testosterone, in the organization of the two male reproductive phenotypes of tree lizards (*Urosaurus ornatus*), which differ in adult levels of territorial behavior. In the present experiment we tested whether progesterone and testosterone could also play an activational role in the expression of adult aggressive behavior. We subjected post-reproductive male tree lizards to the following treatments: sham surgery, castration, castration with progesterone supplementation, and castration with testosterone supplementation. We measured several different dimensions of aggressive behavior. Overall in these post-reproductive animals, the level of aggression from lowest to highest was: castrates, shams, progesterone-treated, and testosterone-treated. Although testosterone appears to be the more potent regulator of aggressive behavior, progesterone enhanced several measures of aggression suggesting that it could play a role in natural regulation of aggressive behavior. This initial study used very high levels of progesterone (similar to or above those experienced by hatchlings) to maximize the probability of detecting an effect. Further studies are needed to determine if natural adult progesterone levels are sufficiently high to influence aggressive behavior.
Descriptors: reptiles, male tree lizards, *Urosaurus ornatus*, aggressive behavior, activation, testosterone, progesterone.

Woolley, S.C., J.T. Sakata, and D. Crews (2004). **Evolutionary insights into the regulation of courtship behavior in male amphibians and reptiles.** *Physiology and Behavior* 83(2): 347-360. ISSN: 0031-9384.
Abstract: Comparative studies of species differences and similarities in the regulation of courtship behavior afford an understanding of evolutionary pressures and constraints shaping reproductive processes and the relative contributions of hormonal, genetic, and ecological factors. Here, we review species differences and similarities in the control of courtship and copulatory behaviors in male amphibians and reptiles, focusing on the role of sex steroid hormones, the neurohormone arginine vasotocin (AVT), and catecholamines. We discuss species differences in the sensory modalities used during courtship and in the neural correlates of these differences, as well as the value of particular model systems for neural evolution studies with regard to reproductive processes. For example, in some genera of amphibians (e.g., Ambystoma) and reptiles (e.g., Cnemidophorus), interspecific hybridizations occur, making it possible to compare the ancestral with the descendant species, and these systems provide a window into the process of behavioral and neural evolution as well as the effect of genome size. Though our understanding of the hormonal and neural correlates of mating behavior in a variety of amphibian and reptilian species has advanced substantially, more studies that manipulate hormone or neurotransmitter systems are required to assess the functions of these systems.
Descriptors: amphibians, reptiles, courtship behavior, male, hormonal, genetic, species differences, copulatory behaviors.

Breeding and Care

Akeret, B. (2004). **Grundlagen der Giftschlangenhaltung. [Basics of venomous snake care.]**. *Draco* 5(1): 37-53 Nr 17. ISSN: 1439-8168.
Descriptors: reptiles , venomous snake, care, basics.
Language of Text: German.

Anonymous (2004). **Het houden en kweken van rattenslangen. [Care and breeding of rat snakes.]**. *Aquarium Hilversum* 74(3): 79-81. ISSN: 0003-729X.
Descriptors: reptiles, rat snakes, breeding, care, breeding techniques.
Language of Text: Dutch.

Barnett, S.L. and B.R. Whitaker (2004). **Indoor care of North American box turtles.** *Exotic DVM* 6(1): 23-29. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, indoor care, *Terrapene carolina*, *Terrapene ornata*, North American box turtles.

Barten, S.L. (2002). **Green iguana management and husbandry.** *Proceedings of the North American Veterinary Conference* 16(16): 891-893. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, iguana, feeding, management , husbandry, *Iguana iguana*, conference proceedings.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida.

Bruchmann, H. (2004). **Zur Biologie, Haltung und Nachzucht von *Liophis poecilogyrus reticulatus* (Parker, 1931), der Goldbauch-Buntnatter. [The biology, care and breeding of the snake *Liophis poecilogyrus reticulatus* (Parker, 1931).]**. *Elaphe* 12(2): 38-45. ISSN: 0943-2485.
Descriptors: reptiles, snake, *Liophis poecilogyrus reticulatus*, captive care and breeding.
Language of Text: German.

Bruchmann, H. (2005). **Zur Biologie, Haltung und Nachzucht der Puget Sund-Strumpfbandnatter, *Thamnophis sirtalis pickeringii* (Baird & Girard, 1853). [The biology, care and breeding of the garter snake *Thamnophis sirtalis pickeringii* (Baird & Girard, 1853).]**. *Elaphe* 13(2): 24-32. ISSN: 0943-2485.
Descriptors: reptiles, garter snake, *Thamnophis sirtalis pickeringii*, breeding, care.
Language of Text: German.

Coutard, C. (2005). **Maintenance en captivite de la Cistude d'Europe. [Captive care of the European pond turtle.]**. *Manouria* 8(29): 37-41. ISSN: 1422-4542.
Descriptors: reptiles, European pond turtle, captive care, husbandry.
Language of Text: French.

Coutard, C. (2006). **Note sur l'elevage et la reproduction de tortues-boites, *Terrapene carolina major* (Agassiz, 1857) et *Terrapene carolina triunguis* (Agassiz, 1857). [Note on the rearing and reproduction of the box turtles, *Terrapene carolina major* (Agassiz, 1857) and *Terrapene carolina triunguis* (Agassiz, 1857).]**. *Manouria* 9(30): 10-20. ISSN: 1422-4542.
Descriptors: reptiles, box turtles, *Terrapene carolina major*, *Terrapene carolina triunguis*, rearing, reproduction, note.
Language of Text: French; Summary in French.

Derby, A. (2005). **Elevage et reproduction en captivite du Cinosterne odorant, *Sternotherus odoratus*. [Rearing and captive reproduction of the musk turtle *Sternotherus odoratus*.]**. *Manouria* 8(26): 6-9. ISSN: 1422-4542.
Descriptors: reptiles, musk turtle, *Sternotherus odoratus*, rearing, captive reproduction.
Language of Text: French.

Diekmann, M. and A. Weyers (2006). **Haltung und Nachzucht der chinesischen Dione-Natter (*Elaphe dione*). [Care and breeding of the Dione snake (*Elaphe dione*).]**. *Reptilia D* 11(2): 64-71 Nr 58. ISSN: 1431-8997.
Descriptors: reptiles, Dione snake, *Elaphe dione*, care, breeding.
Language of Text: German.

Ditzel, N. (2005). ***Lepidophyma flavimaculatum* - terrariehold og opdraet af en levendefodende ogle med jomfrufodsel. [*Lepidophyma flavimaculatum* - care in the terrarium and breeding of a live-bearing parthenogenetic lizard.]**. *Nordisk Herpetologisk Forening* 48(5): 152-159. ISSN: 0900-484X.
Descriptors: reptiles, parthenogenetic lizard, live bearing, captive terrarium, care, breeding, *Lepidophyma flavimaculatum*.
Language of Text: Danish; Summary in English.

Elbech, A. (2004). **Hold og opdraet af *Cuora flavomarginata*, kinesisk aeskeskild-padde. [Captive care and breeding of *Cuora flavomarginata*, the Asian box turtle.]**. *Nordisk Herpetologisk Forening* 47(2): 60-64. ISSN: 0900-484X.
Descriptors: reptiles, Asian box turtle, *Cuora flavomarginata*, care, captivity, breeding.
Language of Text: Danish; Summary in English.

Evers, M. (2005). **Haltung und Vermehrung der Bunten Dornschwanzagame. [Care and breeding of the bright spiny-tailed lizard.]**. *DATZ* 58(1): 24-28. ISSN: 0941-8393.
Descriptors: reptiles, bright spiny tail lizard, *Uromastyx ornata*, breeding, care, captivity, husbandry.
Language of Text: German.

Gaibazzi, G. (2005). **Elevage et reproduction de la platemyde de l'Amazone, *Batrachemys raniceps* (Gray, 1855). [Rearing and reproduction of the turtle *Batrachemys raniceps* (Gray, 1855).]**. *Manouria* 8(27): 27-32. ISSN: 1422-4542.
Descriptors: reptiles, turtle, *Batrachemys raniceps*, reproduction, captive breeding, rearing.
Language of Text: French.

Graff, H. (2004). **Opdraet af moskusskildpadden *Sternotherus odoratus*. [Breeding the musk turtle *Sternotherus odoratus*.]**. *Nordisk Herpetologisk Forening* 47(2): 45-49. ISSN: 0900-484X.
Descriptors: reptiles, musk turtle, *Sternotherus odoratus*, reproduction, breeding, recommendations.
Language of Text: Danish; Summary in Danish and English.

Gray Lovich, K. (2005). **Care and breeding of the emperor flat lizard, *Platysaurus imperator*, in captivity.** *Bulletin of the Chicago Herpetological Society* 40(11): 201-203 . ISSN: 0009-3564.
Descriptors: reptiles, emperor flat lizard, *Platysaurus imperator*, care, breeding, captivity.

Gray, R.L. (2003). ***Desert Lizards: Captive Husbandry and Propagation***, Malabar, USA: Krieger Publishing Company, 130 p. ISBN: 1575241699.
Descriptors: reptiles, desert lizards, care, captive husbandry, propagation.

Groen, J. (2006). ***Boiga dendrophila*. Information concerning the snake-species *Boiga dendrophila* and its husbandry.** *Lacerta* 64(2): 55-63. ISSN: 0023-7051.
Descriptors: reptiles, snake, *Bioga dendrophila*, information, husbandry, care, feeding.
Language of Text: Dutch; Summary in English.

Hallmen, M. (2004). **Haltung und Zucht der Farbform "flame" der Gewoehnlichen Strumpfbandnatter *Thamnophis sirtalis sirtalis* (Linnaeus, 1758). [Care and breeding of the colour form "flame" of the common garter snake *Thamnophis sirtalis sirtalis* (Linnaeus, 1758).]**. *Elaphe* 12(1): 23-28. ISSN: 0943-2485.
Descriptors: reptiles, common garter snake, *Thamnophis sirtalis sirtalis*, flame color variant, care, breeding.
Language of Text: German.

Heathcote, P. (2005). **General reptile husbandry - Part 4.** *Ratel* 32(2): 21-23. ISSN: 0305-1218.
NAL Call Number: QL77.5.R37
Descriptors: reptiles, care, captivity, husbandry, housing, diet.

Heathcote, P. (2005). **General reptile husbandry - Part 3**. *Ratel* 32(1): 3-4. ISSN: 0305-1218.
NAL Call Number: QL77.5.R37
Descriptors: reptiles, care, captivity, husbandry, diet, nutritional requirements, feeding.

Heathcote, P. (2004). **General reptile husbandry - Part 1**. *Ratel* 31(3): 9-12. ISSN: 0305-1218.
NAL Call Number: QL77.5.R37
Descriptors: reptiles, husbandry, breeding, care.

Hennig, A.S. (2004). **Haltung und Zucht der Rotbauch-Spitzkopfschildkroete (*Emydura subglobosa*). [Care and breeding of the red-bellied short-necked turtle (*Emydura subglobosa*).]**. *Reptilia D* 9(2): 70-73 Nr 46. ISSN: 1431-8997.
Descriptors: reptiles, red-bellied-short-necked turtle, *Emydura subglobosa*, care, breeding.
Language of Text: German.

Hennig Schwarz, A.S. (2006). **Keeping and breeding the redbelly shortneck turtle *Emydura subglobosa*.** *Reptilia GB* 45: 62-65. ISSN: 1138-4913.
Descriptors: reptiles, redbelly shortneck turtle, *Emydura subglobosa*, keeping, breeding, care, husbandry, rearing.

Herold, H. (2004). **Gilaoglen *Heloderma suspectum* - historie, fangenskabshold og opdraet. [The Gila lizard *Heloderma suspectum* - history, captive care and breeding.]**. *Nordisk Herpetologisk Forening* 47(6): 189-198. ISSN: 0900-484X.
Descriptors: reptiles, gila lizard, *Heloderma suspectum*, captivea care, captive breeding, reproduction.
Language of Text: Danish; Summary in English.

Hilgenhof, R. and R.J. Hilgenhof (2004). **Zur Kenntnis, Haltung und Nachzucht des Schwertschwanz-Anolis (*Anolis valencienni*) (Dumeril & Bibron, 1837). [Information on the biology, care and breeding of the sword-tailed iguana (*Anolis valencienni*) (Dumeril & Bibron, 1837).]**. *Reptilia D* 9(1): 72-76 Nr 45. ISSN: 1431-8997.
Descriptors: reptiles, sword tailed iguana, *Anolis valencienni*, breeding, care, biology, information.
Language of Text: German.

Hitch, R. (2005). **Bearded buddies an ideal first reptile and its basic care.** *Herptile* 30(3): 93-99. ISSN: 0953-2021.
Descriptors: reptiles, bearded buddies, basic care, captivity, guidelines.

Hjerresen Lynge, I. and S. Hjerresen Lynge (2006). **Den gronne leguan som terrariedyr - 3. del. [The green iguana as a terrarium animal - part 3.]**. *Nordisk Herpetologisk Forening* 49(4): 126-135. ISSN: 0900-484X.
Descriptors: reptiles, green iguana, *Iguana iguana*, terrarium animal, housing, conditions, behavior, captive breeding.
Language of Text: Danish; Summary in English.

Hohmeister, A. (2005). **Biologie, Pflege und Zucht von Mondnattern (Gattung, *Oxyrhopus*, Wagler 1830). [Biology, care and breeding of snakes of the genus *Oxyrhopus*, Wagler 1830.]**. *Reptilia D* 10(3): 46-50 Nr 53. ISSN: 1431-8997.
Descriptors: reptiles, snakes, genus *Oxyrhopus*, biology, care, breeding.
Language of Text: German.

Huchzermeyer, F.W. (2003). ***Crocodiles: Biology, Husbandry and Diseases***, CABI Publishing: Wallingford, 337 p. ISBN: 0851996566.
Descriptors: reptiles, crocodiles, biology, husbandry, diseases.

Jelinek, U. (2005). **Tipps und Ideen zur Haltung von *Iguana iguana*. [Tips and ideas for the care of *Iguana iguana*.]**. *Iguana Rundschreiben* 18(2): 28-29. ISSN: 0949-0450.
Descriptors: reptiles, *Iguana iguana*, care, captivity, tips, ideas.
Language of Text: German.

Jensen, J.H. (2004). **Mine erfaringer med hold og opdraet af halsbandsleguaner, *Crotaphytus collaris*. [My experiences with care and breeding of the eastern collared lizard, *Crotaphytus collaris*.]**. *Nordisk Herpetologisk Forening* 47(2): 34-44. ISSN: 0900-484X.
Descriptors: reptiles, eastern collared lizard, *Crotaphytus collaris*, care, captivity, recommendations, breeding, social behavior.
Language of Text: Danish; Summary in English.

Kitimasak, W., K. Thirakhupt, and D.L. Moll (2003). **Captive breeding of the Siamese narrow-headed softshell turtle *Chitra chitra* Nutphand, 1986 (Testudines: Trionychidae)**. *Thai Journal of Agricultural Science* 36(2): 141-154. ISSN: 0049-3589.
Descriptors: reptiles, captive breeding, Siamese narrow headed softshell turtle, *Chitra chitra*, reproduction.

Koehler, G., K. Griesshammer and N. Schuster (2004). ***Bartagamen: Biologie, Pflege, Zucht, Erkrankungen. [Bearded Lizards: Biology, Breeding, Diseases and Captive Care.].***, Offenbach: Herpeton, 190 p. ISBN: 3936180040.
Descriptors: reptiles, bearded lizards, biology, breeding, diseases, captive care.
Language of Text: German.

Kreutz, R. (2006). **Bau und Betrieb eines Gewaechshauses fuer die Haltung von Echsen. [Construction and operation of a greenhouse for the care of lizards.]**. *Draco* 7(2): 79-83 Nr 26. ISSN: 1439-8168.
Descriptors: reptiles, lizards, care, greenhouse, construction, operstion.
Language of Text: German.

Langerwerf, B. (2005). **Haltung und Nachzucht des Drakensberg-Guertelschweifes (*Cordylus melanotus subviridis*). [Care and breeding of the spiny-tailed lizard (*Cordylus melanotus subviridis*).]**. *Reptilia D* 10(1): 66-69 Nr 51. ISSN: 1431-8997.
Descriptors: reptiles, spiny tailed lizard, *Cordylus melanotus subviridis*, breeding, care, South Africa.
Language of Text: German.

Levy, Y., R. King, and I. Aizenberg (2005). **Holding a live leatherback turtle in Israel: Lessons learned.** *Marine Turtle Newsletter* 107: 7-8. ISSN: 0839-7708.
Online: http://www.seaturtle.org/mtn/archives/mtn107/mtn107p7.shtml

Descriptors: reptiles, leatherback turtle, *Dermochelys coriacea*, live, holding, lessons learned, care, captivity, recommendations, rehabilitation, Israel.

Loehr, V.J.T. (2006). **Captive husbandry of the dwarf plated lizard, *Cordylosaurus subtessellatus* (Smith, 1844), with indications for ecological and behavioural characteristics**. *Herpetological Bulletin* (96): 5-11. ISSN: 1473-0928.
Descriptors: reptiles, dwarf plated lizard, *Cordylosaurus subtessellatus*, captive husbandry, behavioral characteristics, activity pattern, mating.

Lourdais, O., X. Bonnet, R. Shine, D. Denardo, G. Naulleau, and M. Guillon (2002). **Capital-breeding and reproductive effort in a variable environment: a longitudinal study of a viviparous snake**. *Journal of Animal Ecology* 71(3): 470-479. ISSN: 0021-8790.
NAL Call Number: 410 J826
Descriptors: reptiles, viviparous snake, breeding, reproductive effort, variable environment.

Melani, E. (2006). ***Timon lepidus*. Keeping and breeding the ocellated lizard.** *Reptilia GB* 44: 60-65. ISSN: 1138-4913.
Descriptors: reptiles, *Timon lepidus*, ocellated lizard, care, breeding, captivity.

Mende, A. and T. Berndt (2005). **Haltung, Pflege und Nachzucht der Pracht-Erdschildkroete *Rhinoclemmys pulcherrima incisa* (Bocourt, 1868). [Husbandry, care and breeding of the red turtle subspecies *Rhinoclemmys pulcherrima incisa* (Bocourt, 1868).]**. *Marginata* 7: 16-20.
Descriptors: reptiles, red turtle, *Rhinoclemmys pulcherrima incisa*, subspecies, husbandry, care, breeding.
Language of Text: German.

Mitchell, M.A. (2004). **Snake care and husbandry.** *Veterinary Clinics of North America, Exotic Animal Practice* 7(2): 421-446. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: The snake has long been a contradictory species; you either love them or hate them. In the United States, these reptiles are popular pets.There is also a significant amount of energy placed into developing captive breeding programs to produce different color morphs for many species. In some cases, such as the ball pythons (Pythonregius), these color morphs can sell for 20,000 dollars to 30,000 dollars each. In comparison to domestic mammals, snakes are long-lived. It is not uncommon for corn snakes (*Elaphe guttata guttata*) to live for 15 to 25 years and for ball pythons to live 35 to 45 years. Because of the longevity and value of these animals, more snakes are being presented to the veterinarian to manage medical and surgical problems,as well as for routine medical care. Veterinary personnel working with snakes should familiarize themselves with the specific husbandry and medical requirements of these animals so that they can make informed decisions regarding their management.
Descriptors: animal husbandry, captive snakes, veterinary medicine, care.

Noack, M. (2004). **Haltung, Nachzucht und Aufzucht von Baird's Rattern- oder Kletternatter, *Elaphe baird*i (Yarrow, 1880). [Care, breeding and rearing of Baird's rat snake, *Elaphe bairdi* (Yarrow, 1880).]**. *Elaphe* 12(1): 46-49. ISSN: 0943-2485.
Descriptors: reptiles, Baird's rat snake, *Elaphe bairdi*, care, breeding, rearing.
Language of Text: German.

O'Rourke, D.P. (2002). **Reptiles and amphibians as laboratory animals.** *Lab Animal* 31(6): 43-47. ISSN: print: 0093-7355; online: 1548-4475.
NAL Call Number: QL55.A1L33
Abstract: Although reptiles and amphibians have long been used in biomedical research, few in the arena understand their health and husbandry needs. The author provides an introduction to the successful maintenance of reptiles and amphibians in the laboratory environment.
Descriptors: amphibia physiology, animal husbandry, animal welfare, laboratory animals, reptiles physiology.

Oldbort, S. (2003). **Eingewoehnung und Haltung von *Alligator sinensis* Fauvel, 1879. [Housing and care of *Alligator sinensis* Fauvel, 1879.]**. *Elaphe* 11(4): 40-46. ISSN: 0943-2485.
Descriptors: reptiles, alligator, *Alligator sinensis*, housing, care, captivity.
Language of Text: German; Summary in German.

Pawlowski, S. (2005). **Bericht zur erfolgreichen Haltung und Nachzucht der Gelbrand-Scharnierschildkroete, *Cuora flavomarginata*. [Report on the successful maintenance and breeding of the yellow-margined box turtle, *Cuora flavomarginata*.]**. *Radiata* 14(2): 55-59. ISSN: 1615-5475.
Descriptors: reptiles, yellow margined box turtle, *Cuora flavomarginata*, maintenance, breeding, successful, report, reproduction.
Language of Text: German.

Qian GuoYing and Zhu QiuHua (2003). **Effects of living space on nutrient components of Chinese soft-shelled turtle (*Trionyx sinensis*)**. *Acta Hydrobiologica Sinica* 27(2): 217-220. ISSN: 1000-3207.
NAL Call Number: QH540
Descriptors: reptiles, Chinese soft shelled turtle, *Trionyx sinensis*, living space, effects, nutrient componenets, husbandry, farmed animals.
Language of Text: Chinese.

Redrobe, S. (2002). **Reptiles and disease--keeping the risks to a minimum.** *Journal of Small Animal Practice.* 43(10): 471-472. ISSN: print: 0022-4510; online: 1748-5827.
NAL Call Number: 41.8 J8292
Descriptors: reptiles, animal husbandry, guidelines, zoonoses, *Salmonella* infections, prevention, control, tick borne diseases prevention, control.

Reisinger, M. (2006). **Successful long-term keeping and breeding of the Rio Fuerte beaded lizard. *Heloderma horridum exasperatum*.** *Reptilia GB* 47: 25-33. ISSN: 1138-4913.
Descriptors: reptiles, beaded lizard, *Heloderma horridum exasperatum*, breeding, keeping, long term.

Reisinger, M. (2006). **Die erfolgreiche und kontinuierliche Haltung und Nachzucht der Skorpions-Krustenechse *Heloderma horridum exasperatum*. [The successful and continued care and breeding of the Mexican beaded lizard *Heloderma horridum exasperatum*.]**. *Reptilia D* 11(2): 26-35 Nr 58. ISSN: 1431-8997.
Descriptors: reptiles, beaded lizard, *Heloderma horridium exasperatum*, care, breeding, successful.
Language of Text: German.

Rogner, M. (2005). **Wasserschildkroeten Ueber ihre Unterbringung und Ernaehrung. [Turtles. Information on their care and feeding.]**. *Aquarium Bornheim* 431: 66-71. ISSN: 0341-2709.
Descriptors: reptiles, turtles, information, care, feeding, diet, housing.
Language of Text: German.

Schlueter, U. (2004). **Farbenpraechtige Ameiven. Lebensweise, Pflege und Zucht von *Ameiva ameiva*. [Colorful ameiva lizards. Life habit, care and breeding of *Ameiva ameiva*.]**. *Aquaristik Fachmagazin and Aquarium Heute* 36(3): 86-89 Nr 177. ISSN: 1437-4854.
Descriptors: reptiles, Ameiva lizards, *Ameiva ameiva* , life habit, care, breeding.
Language of Text: German.

Schmidt, D. (2004). **Zur Reproduktion von Schlangen im Terrarium Aufgaben - Fakten - Probleme. [The reproduction of snakes in the terrarium. Duties - facts - problems.]**. *Draco* 5(1): 22-36 Nr 17. ISSN: 1439-8168.
Descriptors: reptiles, snakes, reproduction, terrarium, facts, duties, problems.
Language of Text: German.

Schmidt, J. (2003(2004) Dezember-Januar). **Haltung und Vermehrung des Gebaenderten Fidschi-Leguans (*Brachylophus fasciatus* Brongniart, 1800). [The care and breeding of the Fiji banded iguana (*Brachylophus fasciatus* Brongniart, 1800).]**. *Reptilia D* 8(6): 56-63 Nr 44. ISSN: 1431-8997.
Descriptors: reptiles, Fiji banded iguana, *Brachylophus fasciatus*, care, husbandry, breeding.
Language of Text: German.

Stahl, S.J. (2002). **Veterinary management of snake reproduction.** *Veterinary Clinics of North America, Exotic Animal Practice* 5(3): 615-636. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: The reptile veterinarian should approach the breeder with a comprehensive plan involving a review of proper husbandry, nutrition, record keeping, and a thorough prebreeding evaluation of the snakes. In addition, an evaluation of the reproductive strategy, assistance with confirming and monitoring gestation, and a review of potential reproductive complica-

tions will help to prepare the snake owner for a successful breeding season.
Descriptors: reptiles, husbandry, nutrition, review, record keeping, breeding, snake reproduction, veterinarian, evaluation, reproductive strategy.

Staljanssens, P. and J. Nijs (2002). **Captive care and reproduction of the common snapping turtle, *Chelydra s. serpentina*.** *Podarcis* 3(2): 34-42. ISSN: 1567-3871.
Descriptors: reptiles, common snapping turtle, *Chelydra serpentina*, captive care, reproduction.

Svenningsen, J.S. (2006). **Australske ogler 1 Australsk blatungeskink, *Tiliqua scincoides scincoides*, i terrarium. [Australian lizards 1 The Australian blue-tongued lizard, *Tiliqua scincoides scincoides*, in the terrarium.]**. *Nordisk Herpetologisk Forening* 49(4): 147-151. ISSN: 0900-484X.
Descriptors: reptiles, blue tongue lizard, *Tiliqua scincoides scincoides*, terrarium, housing, care.
Language of Text: Danish; Summary in English.

Symanski, D. (2004). **Keeping and breeding McCord's snake-necked turtle *Chelodina mccordi* Rhodin, 1994.** *Radiata* 13(2): 10-16. ISSN: 1615-5475.
Descriptors: reptiles, McCord's snake necked turtle, *Chelodina mccordi*, keeping, breeding, care, captivity.

ter Borg, J.P. (2005). **De Kousebandslang, *Thamnophis sirtalis* een eenvoudige handleiding. [The common garter snake (*Thamnophis sirtalis*), a simple manual.]**. *Lacerta* 63(5): 208-218. ISSN: 0023-7051.
Descriptors: reptiles, common garter snake, *Thamnophis sirtalis*, care, captivity, manual, breeding techniques.
Language of Text: Dutch; Summary in English.

Tversted, M. (2004). **Ostamerikansk aeskeskildpadde - pleje og opdraet. [Eastern box turtles - care and rearing techniques.]**. *Nordisk Herpetologisk Forening* 47(6): 206-213. ISSN: 0900-484X.
Descriptors: reptiles, eastern box turtles, care, rearing, techniques.
Language of Text: Danish; Summary in English.

Uhrig, D. and D.S. Lee (2006). **Care and captive breeding of the highly endangered Vietnam pond turtle, *Mauremys annamensis* (Siebenrock, 1903).** *Radiata* 15(1): 3-10. ISSN: 1615-5475.
Descriptors: reptiles, pond turtle, care, captive breeding, *Mauremys annamensis*, endangered species, Vietnam.

Vogel, G. and P. Freed (2006). **Zur Haltung der Bauchdruesenotter *Maticora bivirgata flaviceps* (Cantor, 1839) im Terrarium. [Care of the blue Malaysian coral snake *Maticora bivirgata flaviceps* (Cantor, 1839) in the terrarium.]**. *Reptilia D* 11(1): 72-76 Nr 57. ISSN: 1431-8997.

Descriptors: reptiles, blue Malaysian coral snake, *Maticora bivirgata flaviceps*, care, terrarium.
Language of Text: German.

Wappel, S.M. and M.S. Schulte (2004). **Turtle care and husbandry.** *Veterinary Clinics of North America, Exotic Animal Practice* 7(2): 447-472. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Chelonians (turtles, tortoises, and terrapins) are not as well represented in private reptile collections as are snakes and lizards. This may be due in part to the fact that they often require more space and time for proper care. Nonetheless, they are still popular pets. Unfortunately, many people are not aware of what constitutes proper care for these animals. This article will discuss basic captive husbandry and nutrition issues of common chelonians, as well as recognizing illness, capture and restraint, sample collection, medication administration, and preventive care.
Descriptors: reptiles, turtles, tortoises, terrapins, care, husbandry, veterinary medicine, chelonians, private collections, pets.

Waterloo, B. and M.K. Bayless (2006). **Notes on the breeding behaviour of the crocodile monitor (*Varanus salvadorii*) in captivity**. *Herpetological Bulletin*(98): 2-6. ISSN: 1473-0928.
Descriptors: reptiles, crocodile monitor, captive, *Varanus salvadorii*, breeding behavior, notes , husbandry, care.

Weiss, T. (2004). **Pflege, Haltung und Nachzucht des Oestlichen Halsbandleguans, *Crotaphytus collaris collaris* (Say, 1823). [Care, husbandry and breeding of the eastern collared lizard *Crotaphytus collaris collaris* (Say, 1823).]**. *Elaphe* 12(4): 47-55. ISSN: 0943-2485.
Descriptors: reptiles, eastern collard lizard, *Crotaphytus collaris collaris*, care, breeding, husbandry.
Language of Text: German.

Wilson, S.C., H.W. Holder, J.M. Martin, T.L. Brasel, L.A. Andriychuk, C. Wu, D.C. Straus, and R. Aguilar (2006). **An indoor air quality study of an alligator (*Alligator mississippiensis*) holding facility.** *Journal of Zoo and Wildlife Medicine* 37(2): 108-115. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, alligators, *Alligator mississippiensis*, holding facility, indoor air quality, study, contamination, mortality, fungal, microbial.

Zhang, F.Y. and H.X. Gu (2005). **Artificial feeding of baby turtle of *Chelonia mydas*.** *Sichuan Journal of Zoology* 24(3): 412-413. ISSN: 1000-7083.
Descriptors: reptiles, baby turtle, *Chelonia mydas*, diet, captivity, artificial feeding.
Language of Text: Chinese; Summary in Chinese and English.

Cardiovascular

Ahmad, M., R. Hasan, T. Naim, M. Ahmad, and T.B. Hanif (2003). **The effect of isoniazid (INH) on erythrocyte sedimentation rate in the lizard, *Uromastix hardwickii.*** *Journal of Applied Sciences* 38-39: 544-548. ISSN: 1607-8926.

Abstract: Erythrocyte sedimentation rate of isoniazid treated lizard was worked out. The gradual decrease for day 5 to day 10 and day 15 was found to be statistically significant. This is indicative of increase in erythrocyte membrane permeability with increase in the span of treatment. Newer cells are flooded in the blood stream due to loss of older cells. Newer cell resist sedimentation on day 10 and day 15.

Descriptors: reptiles, lizard, isoniazid, INH, effect , erythrocyte sedimentation rate, membrane permeability.

Ahmed, M., M. Ahmad, R. Hasan, A. Qureshi, and Z. Ahmed (2006). **The effects of mefenamic acid on hematocrit of the lizard, *Uromastix hardwickii.*** *Pakistan Journal of Pharmaceutical Sciences* 19(1): 48-51. ISSN: 1011-601X.

Abstract: Mefenamic acid is an analgesic, antipyretic and anti-inflammatory agent. In addition induces several hematological disturbances. Present study was conducted to determine the alterations in blood PCV of the lizard *Uromastix hardwickii* after the administration of 7.1 mg/ml; 10.5 mg/ml and 14.0 mg/ml mefenamic acid per individual per day for 12 days to 3 test groups. The mean values of PCV were 15.5+/-0.81%, 14.5+/-0.25% and 12.0+/-0.25% for 3 test groups respectively in comparison to 23.5+/-0.40% for control. Thus a significant dose dependant reduction in mean PCV per cent following the administration of mefenamic acid for 12 days indicates the extra vascular hemolysis due to destructive change in the red cell membrane through autoantibody mechanism.

Descriptors: lizard, anti-inflammatory agents, non-steroidal pharmacology, lizards blood, mefenamic acid pharmacology, anemia, hemolytic, autoimmune chemically induced, hematocrit.

Al Habsi, A.A., A.Y.A. Alkindi, I.Y. Mahmoud, D.W. Owens, T. Khan, and A. Al Abri (2006). **Plasma hormone levels in the green turtles *Chelonia mydas* during peak period of nesting at Ras Al-Hadd-Oman**. *Journal of Endocrinology* 191(1): 9-14. ISSN: 0022-0795.

Online: http://dx.doi.org/10.1677/joe.1.06790

NAL Call Number: 448.8 J8293

Descriptors: reptiles, green turtles, nesting, peak period, plasma hormone levels, estradiol, progesterone, testosterone, corticosterone.

Aldrich, K.J., D.K. Saunders, L.M. Sievert, and G. Sievert (2006). **Comparison of erythrocyte osmotic fragility among amphibians, reptiles, birds and mammals**. *Transactions of the Kansas Academy of Science* 109(3-4): 149-158. ISSN: 0022-8443.

NAL Call Number: 500 K13T

Descriptors: reptiles, erythrocyte, osmotic fragility, comparison study, amphibians, reptiles, mammals.

Alkindi, A.Y.A. and I.Y. Mahmoud (2002). **A new method of sampling arterial blood from large sea turtles.** *Herpetological Review* 33(4): 281-282. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, large sea turtles, arterial blood, sampling, new method.

Azevedo, A., L. Casaletti, and L.O. Lunardi (2002). **Morphology and histoenzymology of eosinophilic granulocytes in the circulating blood of the turtle (*Chrysemys dorbignih*).** *Journal of Submicroscopic Cytology and Pathology* 34(3): 265-269. ISSN: 1122-9497.
Abstract: The studies on the characterization of eosinophils and neutrophils/heterophils of turtles are contradictory. Some authors have pointed out the existence of two distinct cell types: eosinophils and heterophils. Other authors have proposed that eosinophils and heterophils may be the same cells in different stages of maturation. These interpretations are based only on a morphological analysis. In the blood of the turtle (*Chrysemys dorbignih*), a South American freshwater species, there are two types of granulocytes with eosinophilic staining pattern: the first with round cytoplasmic granules and the second with ellipsoidal cytoplasmic granules. In the present study by using histoenzymological methods for the analyses of enzymological cellular content, we found that the cells with round cytoplasmic granules were positive for nonspecific esterase and the cells with ellipsoidal granules were positives for acid phosphatase, alkaline phosphatase, nonspecific esterase and peroxidase. The results show that these cells are distinct cells and that the cells with ellipsoidal cytoplasmic granules have the same histoenzymological characteristics as the neutrophils/heterophils of mammalians and other vertebrates.
Descriptors: reptiles, turtle, *Chysemys dorbignih*, blood, eosinophilic granulocytes, morphology, histoenzymology, neutrophils, heterophils.

Azevedo, A. and L.O. Lunardi (2003). **Cytochemical characterization of eosinophilic leukocytes circulating in the blood of the turtle (*Chrysemys dorbignih*).** *Acta Histochemica* 105(1): 99-105. ISSN: 0065-1281.
Abstract: Eosinophils and neutrophils are granulocytic leukocytes that are present in the blood of most vertebrates. Studies have been performed on lower vertebrates to understand the biological roles of the cells in defense mechanisms and to establish phylogenetic studies and new experimental models. Whether these 2 cell types exist in reptiles is a matter of controversy. In the blood of turtles there are 2 types of granulocytes that exhibit eosinophilia, one of them with round cytoplasmic granules and the other with elongated cytoplasmic granules. It has been suggested that these cells may be eosinophils in different stages of maturation but they also may be distinct cell types, i.e. eosinophils and neutrophils. In the present study, we characterized the 2 types of granulocytes that are present in the blood of *Chrysemys dorbignih*, using cytochemical techniques. Type I eosinophils showed activity of nonspecific esterase, peroxidase activity that is resistant to KCN, and basic proteins. Type II eosinophils exhibited activity of trimetaphosphatase, alkaline phosphatase, nonspecific esterase, peroxidase that is sensitive to KCN, and basic proteins. These observations indicate the existence of

2 distinct cell types in the blood of *Chrysemys dorbignih*, type I and type II eosinophils, that correspond to eosinophils and heterophils (neutrophils) of mammals and other vertebrates.
Descriptors: reptiles, turtle, *Chrysemys dorbignih*, circulating blood, eosinophilic leukocytes, cytochemical characterization, eosinophils, neutrophils.

Beraldo, F.H., R. Sartorello, M.L. Gazarini, W. Caldeira, and C.R.S. Garcia (2002). **Red blood cells of the lizards *Ameiva ameiva* (squamata, teiidae) display multiple mechanisms to control cytosolic calcium**. *Cell Calcium* 31(2): 79-87. ISSN: 0143-4160.
Descriptors: reptiles, red blood cells, lizards, mechanisms, control cytosolic calcium.

Birkedal, R. and H. Gesser (2004). **Effects of hibernation on mitochondrial regulation and metabolic capacities in myocardium of painted turtle (*Chrysemys picta*).** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 139(3): 285-291. ISSN: 1095-6433.
Abstract: Painted turtles hibernating during winter may endure long-term exposure to low temperature and anoxia. These two conditions may affect the aerobic capacity of a tissue and might be of particular importance to the cardiac muscle normally highly reliant on aerobic energy production. The present study addressed how hibernation affects respiratory characteristics of mitochondria in situ and the metabolic pattern of turtle myocardium. Painted turtles were acclimated to control (25 degrees C), cold (5 degrees C) normoxic and cold anoxic conditions. In saponin-skinned myocardial fibres, cold acclimation increased mitochondrial respiratory capacity and decreased apparent ADP-affinity. Concomitant anoxia did not affect this. Creatine increased the apparent ADP-affinity to similar values in the three acclimation groups, suggesting a functional coupling of creatine kinase to mitochondrial respiration. As to the metabolic pattern, cold acclimation decreased glycolytic capacity in terms of pyruvate kinase activity and increased lactate dehydrogenase (LHD) activity. Concomitant anoxia counteracted the cold-induced decrease in pyruvate kinase activity and increased creatine kinase activity. In conclusion, cold acclimation seems to increase aerobic and decrease anaerobic energy production capacity in painted turtle myocardium. Importantly, anoxia does not affect the mitochondrial functional integrity but seems to increase the capacity for anaerobic energy production and energy buffering.
Descriptors: reptiles, painted turtle, hibernation, effects, metabolic capacities, myocardium, mitochondrial regulation, anoxia, low temperature.

Broughton, B.R.S. and J.A. Donald (2003). **Nitric oxide regulation of blood vessels in amphibians, reptiles and birds.** *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 134A(Suppl. 1): S47. ISSN: 1095-6433.
Descriptors: amphibians, reptiles, birds, nitric oxide, regulation, blood vessels, cardiovascular system, transport, circulation, meeting.
Notes: Meeting Information: Sixth International Congress of Comparative Physiology and Biochemistry, Mt Buller, Australia; February 2-7, 2003.

Broughton, B.R.S. and J.A. Donald (2007). **Dual mechanisms for nitric oxide control of large arteries in the estuarine crocodile *Crocodylus porosus*.** *Journal of Experimental Biology* 210(1): 129-137. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.02620
NAL Call Number: 442.8 B77
Descriptors: reptiles, nitric oxide control, large arteries, duel mechanisms, crocodile, systemic vasculature.

Bulte, G., C. Verly, and G. Blouin Demers (2006). **An improved blood sampling technique for hatchling emydid turtles**. *Herpetological Review* 37(3): 318-319. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, emydid turtles, hatchling, improved blood sampling technique.

Casal, A.B. and J. Oros (2007). **Morphologic and cytochemical characteristics of blood cells of juvenile loggerhead sea turtles (*Caretta caretta*).** *Research in Veterinary Science* 82(2): 158-165. ISSN: 0034-5288.
Abstract: A morphologic classification based on the cytochemical characteristics of blood cells of 35 juvenile loggerhead sea turtles (*Caretta caretta*) is described. Cytochemical stains included benzidine peroxidase, chloroacetate esterase, alpha-naphthyl butyrate esterase (with and without sodium fluoride), acid phosphatase (with and without tartaric acid), Sudan black B, periodic acid-Schiff, and toluidine blue. The morphologic characteristics of erythrocytes were similar to those reported in green turtles. Six types of white blood cells were identified: heterophils, eosinophils, basophils, lymphocytes, monocytes and thrombocytes. Except for the basophils, the rest of the white blood cells from loggerhead turtles had different cytochemical characteristics compared to blood cells from other sea turtle species. The leukocyte differential count was different from that reported for other sea turtle species. Heterophils were the most numerous leukocytes from these loggerhead turtles, followed by lymphocytes, eosinophils, monocytes and basophils. This paper provides a morphologic classification of blood cells of loggerhead sea turtles that is useful for veterinary surgeons involved in sea turtle conservation.
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, blood cells, cytochemical characteristics, morphological, juvenile, veterinary medicine.

Chen, R.F., P.F. Yang, J.H. Hsieh, and C.T. Yen (2002). **Vagal control of heart rate and ventricular contractility in turtles.** *Society for Neuroscience Abstract Viewer and Itinerary Planner* 2002: Abstract No. 859.2. ISSN: 1529-2401.
Online: http://sfn.scholarone.com
Descriptors: reptiles, turtles, heart rate, ventricular contractility, vagal control, vagal nerve, meeting.
Notes: Meeting Information: 32nd Annual Meeting of the Society for Neuroscience, Orlando, Florida, USA; November 2-7, 2002.

Clark, T.D., T. Wang, P.J. Butler, and P.B. Frappell (2005). **Factorial scopes of cardio-metabolic variables remain constant with changes in body temperature in the varanid lizard, *Varanus rosenbergi.*** *American Journal of Physiology. Regulatory, Integrative and Comparative Physiology* 288(4): R992-R997. ISSN: print: 0363-6119; online: 1522-1490.
Online: http://dx.doi.org/10.1152/ajpregu.00593.2004
Abstract: The majority of information concerning the cardio-metabolic performance of varanids during exercise is limited to a few species at their preferred body temperature (T(b)) even though, being ectotherms, varanids naturally experience rather large changes in T(b). Although it is well established that absolute aerobic scope declines with decreasing T(b), it is not known whether changes in cardiac output (V(b)) and/or tissue oxygen extraction, (Ca(O2) - Cv(O2)), are in proportion to the rate of oxygen consumption (Vo(2)). To test this, we studied six Rosenberg's goannas (Varanus rosenbergi) while at rest and while maximally exercising on a treadmill both at 25 and 36 degrees C. During maximum exercise both at 25 and 36 degrees C, mass-specific rate of oxygen consumption (Vo(2kg)) increased with an absolute scope of 8.5 ml min(-1) kg(-1) and 15.7 ml min(-1) kg(-1), respectively. Interestingly, the factorial aerobic scope was temperature-independent and remained at 7.0 which, at each T(b), was primarily the result of an increase in V(bkg), governed by approximate twofold increases both in heart rate (f(H)) and cardiac stroke volume (V(Skg)). Both at 25 degrees C and 36 degrees C, the increase in V(bkg) alone was not sufficient to provide all of the additional oxygen required to attain maximal Vo(2kg), as indicated by a decrease in the blood convection requirement V(bkg)/Vo(2kg); hence, there was a compensatory twofold increase in (Ca(O2) - Cv(O2)). Although associated with an increase in hemoglobin-oxygen affinity, a decrease in T(b) did not impair unloading of oxygen at the tissues and act to reduce (Ca(O2) - Cv(O2)); both Ca(O2)) and Cv(O2)) were maintained across T(b). The change in Vo(2kg) with T(b), therefore, is solely reliant on the thermal dependence of V(bkg). Maintaining a high factorial aerobic scope across a range of T(b) confers an advantage in that cooler animals can achieve higher absolute aerobic scopes and presumably improved aerobic performance than would otherwise be achievable.
Descriptors: varanid lizard, body temperature, physiology, hemodynamic processes, metabolism, blood gas analysis, cardiac output, exertion, heart rate, oxygen consumption, seasons, temperature.

Crossley, D.A.I. and J. Altimiras (2005). **Cardiovascular development in embryos of the American alligator *Alligator mississippiensis*: effects of chronic and acute hypoxia.** *Journal of Experimental Biology* 208(1): 31-39. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01355
NAL Call Number: 442.8 B77
Descriptors: reptiles, *Alligator mississippiensis*, circulatory system, cardiovascular development, acute hypoxia, embryo cardiovascular development, effects of chronic hypoxia, American alligator, North America.

Dbrowski, Z., I.S. Sano Martins, Z. Tabarowski, E. Witkowska Pelc, D.D. Spadacci Morena, K. Spodaryk, and D. Podkowa (2007). **Haematopoiesis in snakes (Ophidia) in early postnatal development.** *Cell and Tissue Research* 328(2): 291-299. ISSN: 0302-766X.

Abstract: The occurrence of haematopoiesis has been studied in various parts of the spine and in the ribs in four species of snakes (*Boa constrictor L., Elaphe guttata L., Lamprophis fulaginosus Boie., Bothrops jararaca Wied.*) from hatching until 150 days of postnatal development. Marrow spaces are formed by chondrolysis with various time frames depending on the studied species. Marrow cells egress to the general circulation in two ways: via migration through the endothelial cells lining the venous sinuses or by the rupture of protrusions. Erythroblasts are present in the lumen of marrow sinuses suggesting their final maturation there. Various relationships of the spleen to the pancreas have been found. No myelopoietic foci occur in the spleen, liver or kidney of any of the studied species. However, erythropoiesis (sparse islets) has been observed in *Bothrops jararaca* spleen.
Descriptors: reptiles, snakes, hematopoiesis, spine, ribs, hatching, postnatal development, marrow spaces, erythroblasts.

Deem, S.L., E.S. Dierenfeld, G.P. Sounguet, A.R. Alleman, C. Cray, R.H. Poppeng, T.M. Norton, and W.B. Karesh (2006). **Blood values in free-ranging nesting leatherback sea turtles (*Dermochelys coriacea*) on the coast of the republic of Gabon**. *Journal of Zoo and Wildlife Medicine* 37(4): 464-471. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, leatherback sea turtles, blood values, hematology, plasma biochemistry, plasma protein electrophoresis.

Dunlap, K.D. (2006). **Ontogeny and scaling of hematocrit and blood viscosity in western fence lizards, *Sceloporus occidentalis*.** *Copeia* 2006(3): 535-538. ISSN: 0045-8511.
Descriptors: reptiles, fence lizards, *Sceloporus occidentalis*, hematocrit, blood vidcosity, ontogeny, scaling, volume.

Dutton, C.J. and P. Taylor (2003). **A comparison between pre- and posthibernation morphometry, hematology, and blood chemistry in viperid snakes.** *Journal of Zoo and Wildlife Medicine* 34(1): 53-58. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Abstract: Snakes from temperate climates are often made to hibernate in zoos to stimulate reproduction. Unfortunately, deaths have occurred during and after hibernation. This study evaluated the health status, pre- and posthibernation, of 31 adult viperid snakes. It included morphometric measurements, hematology, and blood chemistry. No differences were seen in body weights and weight to length ratios between pre- and posthibernation examinations, suggesting that the overall condition of the snakes did not change. No differences were seen in hematologic and blood chemistry parameters, except that bile acids (3alpha-hydroxybile acids) decreased, the implications of which are unknown. Three individuals had markedly high plasma uric acid levels posthibernation; of these, two individuals died from extensive visceral gout and one recovered with fluid therapy. Viperid snakes should be clinically healthy, well hydrated, and in good body condition when they are put into hibernation. They should be maintained in an environment with sufficient humidity and should have access to water. Blood samples should be collected on arousal for measuring plasma uric acid levels. Changes in morphometry, hematology, and blood chemistry appear to be abnormal and

should be investigated thoroughly.
Descriptors: reptiles, viperid snakes, prehibernation, posthibernation, comparison hematology, blood chemistry, morphometry.

Farmer, C.G. and J.W. Hicks (2002). **The intracardiac shunt as a source of myocardial oxygen in a turtle, *Trachemys scripta*.** *Integrative and Comparative Biology* 42(2): 208-215. ISSN: print: 1540-7063; online: 1557-7023.
NAL Call Number: QL1.I67
Descriptors: reptiles, turtle, *Trachemys scripta*, intracardiac shunt, myocardial oxygen, source.

Franklin, C.E. and F. Seebacher (2003). **The effect of heat transfer mode on heart rate responses and hysteresis during heating and cooling in the estuarine crocodile *Crocodylus porosus*.** *Journal of Experimental Biology.* 206(Pt 7): 1143-1151. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.00222
NAL Call Number: 442.8 B77
Abstract: The effect of heating and cooling on heart rate in the estuarine crocodile *Crocodylus porosus* was studied in response to different heat transfer mechanisms and heat loads. Three heating treatments were investigated. *C. porosus* were: (1) exposed to a radiant heat source under dry conditions; (2) heated via radiant energy while half-submerged in flowing water at 23 degrees C and (3) heated via convective transfer by increasing water temperature from 23 degrees C to 35 degrees C. Cooling was achieved in all treatments by removing the heat source and with *C. porosus* half-submerged in flowing water at 23 degrees C. In all treatments, the heart rate of C. porosus increased markedly in response to heating and decreased rapidly with the removal of the heat source. Heart rate during heating was significantly faster than during cooling at any given body temperature, i.e. there was a significant heart rate hysteresis. There were two identifiable responses to heating and cooling. During the initial stages of applying or removing the heat source, there was a dramatic increase or decrease in heart rate ('rapid response'), respectively, indicating a possible cardiac reflex. This rapid change in heart rate with only a small change or no change in body temperature (<0.5 degrees C) resulted in Q(10) values greater than 4000, calling into question the usefulness of this measure on heart rate during the initial stages of heating and cooling. In the later phases of heating and cooling, heart rate changed with body temperature, with Q(10) values of 2-3. The magnitude of the heart rate response differed between treatments, with radiant heating during submergence eliciting the smallest response. The heart rate of *C. porosus* outside of the 'rapid response' periods was found to be a function of the heat load experienced at the animal surface, as well as on the mode of heat transfer. Heart rate increased or decreased rapidly when *C. porosus* experienced large positive (above 25 W) or negative (below -15 W) heat loads, respectively, in all treatments. For heat loads between -15 W and 20 W, the increase in heart rate was smaller for the 'unnatural' heating by convection in water compared with either treatment using radiant heating. Our data indicate that changes in heart rate constitute a thermoregulatory mechanism that is modulated in response to the thermal environment occupied by the animal, but that heart rate during heating and cooling is, in part, controlled independently of body temperature.

Descriptors: reptiles, estuarine crocodile, *Crocodylus porosus*, heat transfer mode, heart rate response, effect, hysteresis, heating, cooling, body temperature.

Frappell, P.B., T.J. Schultz, and K.A. Christian (2002). **The respiratory system in varanid lizards: determinants of O(2) transfer.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 133(2): 239-258. ISSN: 1095-6433.

Abstract: Varanids in general exhibit greater aerobic capacities than other lizards. In a similar approach to the extensive investigations undertaken in mammals, the respiratory system in varanids is examined in terms of oxygen transfer from the air to the blood during rest and sustained locomotory activity. The parameters controlling the transfer of O(2) through the various steps of the respiratory system are appropriate to meet the maximum demands for oxygen with one possible exception, circulatory convection. Ventilatory convection is maintained during maximal aerobic locomotion ensuring adequate pulmonary ventilation and the protection of alveolar P(O(2)). Little evidence exists to indicate a mechanically imposed constraint to breathe and the possibility of a gular pump acting to assist ventilation, as a general feature of varanids remains to be determined. Alterations in the relative contributions of the ventilation-perfusion ratio, pulmonary diffusion, diffusion equilibrium and right-left shunts preserved the alveolar-arterial P(O(2)) difference, ensuring that arterial oxygenation was maintained. In those species where increases in cardiac output were limited, maximum O(2) transfer was achieved through increased extraction of oxygen at the tissues. Overall, the interrelationship of adjacent steps in the respiratory system ensures that one step cannot become limiting. Compensatory changes occur in various parameters to offset those parameters that are 'limited'. The high aerobic activity of varanid lizards would not be achievable without a compensated circulatory convection.

Descriptors: reptiles, varanid lizards, respiratory system, oxygen transfer, aerobic capacities, blood, air.

Gal, J. (2004). **A hullok verkepzo es keringesi szerveinek fontosabb megbetegedesei. [Major diseases of hemopoetic and circulatory systems of reptiles].** *KisallatPraxis* 5(3): 134-136. ISSN: 1585-9142.

NAL Call Number: SF981.K573

Descriptors: reptiles, major diseases, hemopoetic system, circulatory system.

Language of Text: Hungarian; Summary in English.

Gal, J. (2003). **Meszsolerakodas vitorlas agama (*Hydrosaurus amboinensis*) verereiben. [Calcification in blood vessels of a sailfin lizard (*Hydrosaurus amboinensis*)].** *Magyar Allatorvosok Lapja* 125(11): 687-689. ISSN: 0025-004X.

Descriptors: reptiles, lizard, blood vessels, calcification, nutrition.

Language of Text: Hungarian; Summary in English.

Galli, G., E.W. Taylor, and T. Wang (2004). **The cardiovascular responses of the freshwater turtle *Trachemys scripta* to warming and cooling.** *Journal of Experimental Biology.* 207(Pt 9): 1471-1478. ISSN: 0022-0949.

Online: http://dx.doi.org/10.1242/jeb.00912

NAL Call Number: 442.8 B77

Abstract: Seven freshwater turtles *Trachemys scripta* were instrumented with flow probes and cannulated for blood pressure measurements. The turtles were warmed from 24 to 34 degrees C, and cooled down to 24 degrees C, with and without atropine. Animals exhibited a hysteresis of heart rate and blood flow to both the pulmonary and systemic circulations, which was not cholinergically mediated. Blood pressure remained constant during both warming and cooling, while systemic resistance decreased during heating and increased during cooling, indicating a barostatic response. There was a large right-to-left (R-L) shunt during warming and cooling in untreated animals, which remained relatively constant. Atropinisation resulted in a large L-R shunt, which decreased during warming and increased during cooling. Nevertheless, heating rates were the same in untreated and atropinised animals, and cooling rates were significantly longer in atropinised animals, indicating that shunt patterns contribute little to heat exchange.

Descriptors: reptiles, freshwater turtle, *Trachemys scripta*, cardiovascular responses, warming, cooling, atropine, blood pressure, body temperature, shunt.

Galli, G.L., H. Gesser, E.W. Taylor, H.A. Shiels, and T. Wang (2006). **The role of the sarcoplasmic reticulum in the generation of high heart rates and blood pressures in reptiles.** *Journal of Experimental Biology.* 209(Pt 10): 1956-1963. ISSN: 0022-0949.

Online: http://dx.doi.org/10.1242/jeb.02228

NAL Call Number: 442.8 B77

Abstract: The functional significance of the sarcoplasmic reticulum (SR) in the generation of high heart rates and blood pressures was investigated in four species of reptile; the turtle, *Trachemys scripta*; the python, *Python regius*, the tegu lizard, *Tupinanvis merianae*, and the varanid lizard, *Varanus exanthematicus*. Force-frequency trials and imposed pauses were performed on ventricular and atrial tissue from each species with and without the SR inhibitor ryanodine, and in the absence and presence of adrenaline. In all species, an imposed pause of 1 or 5 min caused a post-rest decay of force, and a negative force-frequency response was observed in all species within their in vivo frequency range of heart rates. These relationships were not affected by either ryanodine or adrenaline. In ventricular strips from varanid lizards and pythons, ryanodine caused significant reductions in twitch force within their physiologically relevant frequency range. In atrial tissue from the tegu and varanid lizards, SR inhibition reduced twitch force across the whole of their physiological frequency range. In contrast, in the more sedentary species, the turtle and the python, SR inhibition only decreased twitch force at stimulation frequencies above maximal in vivo heart rates. Adrenaline caused an increase in twitch force in all species studied. In ventricular tissue, this positive inotropic effect was sufficient to overcome the negative effects of ryanodine. In atrial tissue however, adrenaline could only ameliorate the negative effects of ryanodine at the lower pacing frequencies. Our results indicate that reptiles recruit Ca2+ from the SR for force development in a frequency and tissue dependent manner. This is discussed in the context of the development of high reptilian heart rates and blood pressures.

Descriptors: reptiles, turtle, *Trachemys scripta*, tegu lizard, *Tupinanvis merianae*, python, *Python regius*, varanid lizaed, *Varanus exanthematicus*, blood pressure, heart rate, lizards physiology, sarcoplasmic reticulum, myocardium.

Gelli, D., M. Morgante, V. Ferrari, A. Mollo, D. Freggi, and S. Romagnoli (2004). **Hematologic, serum biochemical, and serum electrophoretic patterns in loggerhead sea turtles (*Caretta caretta*).** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 149-152. ISSN: 1529-9561.
NAL Call Number: SF996.A77
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, hematologic, serum biochemical, serum electrophoretic, patterns.

Gordos, M.A., C.E. Franklin, C.J. Limpus, and G. Wilson (2004). **Blood-respiratory and acid-base changes during extended diving in the bimodally respiring freshwater turtle *Rheodytes leukops*.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 174(4): 347-354. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: Changes in blood-gas, acid-base, and plasma-ion status were investigated in the bimodally respiring turtle, *Rheodytes leukops*, during prolonged dives of up to 12 h. Given that *R. leukops* routinely submerges for several hours, the objective of this study was to determine whether voluntarily diving turtles remain aerobic and simultaneously avoid hypercapnic conditions over increasing dive lengths. Blood PO(2), PCO(2), and pH, as well as plasma concentrations of lactate, glucose, Na(+), K(+), Cl(-), total Ca, and total Mg were determined in venous blood collected from the occipital sinus. Blood PO(2) declined significantly with dive length; however, oxy-haemoglobin saturation remained greater than 30% for all *R. leukops* sampled. No changes were observed in blood PCO(2), pH, [HCO(3)(-)], or plasma glucose, with increasing dive length. Despite repeated dives lasting more than 2 h, plasma lactate remained less than 3 mmol l(-1) for all R. leukops sampled, indicating the absence of anaerobiosis. Compensatory acid-base adjustments associated with anaerobiosis (e.g. declining [Cl(-)], increasing total [Ca] and [Mg]) were likewise absent, with plasma-ion concentrations remaining stable with increasing dive length. Results indicate that *R. leukops* utilises aquatic respiration to remain aerobic during prolonged dives, thus effectively avoiding the development of a metabolic and respiratory acidosis.
Descriptors: reptiles, freshwater turtle, *Rheodytes leukops*, extended diving, acid-base changes, blood-respiratory, bimodally respiring.

Goris, R.C., Y. Atobe, M. Nakano, K. Funakoshi, and K. Terada (2007). **Blood flow in snake infrared organs: response-induced changes in individual vessels.** *Microcirculation* 14(2): 99-110. ISSN: 1073-9688.
Abstract: OBJECTIVE: In the past the microkinetics of blood flow in the infrared pit organs of pit vipers has been studied with Doppler flowmetry using various infrared stimuli such as a human hand or soldering iron at various distances, lasers of various wavelengths, etc. Quick-acting variations in blood flow were recorded, and interpreted as a cooling mechanism for avoiding afterimage in the infrared receptors. However, the Doppler measurements provided only the summation of blood flow in a number of vessels covered by the sensing probe, but did not give data on flow in individual vessels. METHODS: In the present work the authors introduced into the bloodstream of Gloydius and Trimeresurus pit vipers fluorescent microspheres labeled with fluorescein isothiocyanate (FITC) contained in a solution of

FITC-dextran in physiological saline. They observed the passage of the microspheres through individual pit organ vessels with a fluorescent microscope to which was attached a high-speed video camera and image intensifier. Output of the camera was recorded before, during, and after stimulus with a 810-nm diode laser. Recording was done at 250 frames/s on high-speed video apparatus and downloaded to a hard disk. Disk files were loaded into proprietary software and particles were tracked and average velocities calculated. The data were then tested for significance by ANOVA with post hoc tests. RESULTS: A significant ($p<.05$) increase in blood velocity was found at the focal point of the stimulus laser, but not anywhere removed from this point. Proximal severing of the pit sensory nerves caused degeneration of the pit receptor terminals and abolished stimulus-induced blood flow changes, but did not affect normal blood flow. CONCLUSIONS: The authors conclude that the receptors themselves are directly and locally controlling the smooth muscle elements of the blood vessels, in response to heating of the receptors by infrared radiation. They speculate that the heavy vascularization constitutes a cooling system for the radiation-encoding receptors, and further that the agent of control may be a volatile neuromediator such as nitric oxide.
Descriptors: reptiles, snake, infrared pit organs, blood flow, induced changes, microkinetics, smooth muscle elements, blood vessels.

Hanley, C.S., S.J. Hernandez Divers, S. Bush, and K.S. Latimer (2004). **Comparison of the effect of dipotassium ethylenediaminetetraacetic acid and lithium heparin on hematologic values in the green iguana (*Iguana iguana*).** *Journal of Zoo and Wildlife Medicine* 35(3): 328-332. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Abstract: We compared the effects of dipotassium ethylenediaminetetraacetic acid (EDTA) and lithium heparin on hematologic values of green iguanas (*Iguana iguana*). Thirty-two privately owned sibling iguanas had blood drawn, and the sample was divided into three components: an EDTA tube, a heparin tube, and a nonanticoagulated blood smear. A full reptilian complete blood count was performed on each anticoagulated sample, and white blood cell (WBC) and leukocyte differential counts were performed on the whole-blood smears. Heparin and EDTA samples differed significantly in absolute values of thrombocytes, WBC, heterophils, and monocytes. The EDTA had no significant effect on the packed cell volume or plasma protein values, and the white blood count and differential counts produced with EDTA were more similar to those of the nonanticoagulated blood smear than were the counts produced with heparin.
Descriptors: reptiles, green iguana, hematologic values, dipotassium ethylenediaminetetraacetic acid, lithium heparin, anticoagulants, effects, blood count.

Harms, C.A., K.M. Mallo, P.M. Ross, and A. Segars (2003). **Venous blood gases and lactates of wild loggerhead sea turtles (*Caretta caretta*) following two capture techniques.** *Journal of Wildlife Diseases* 39(2): 366-374. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Abstract: During summer of 2001, venous blood gases were determined in loggerhead sea turtles (*Caretta caretta*) captured by trawl (n = 16) in coastal waters of South Carolina and Georgia (USA) as part of a sea turtle census program and captured in pound nets (n = 6) in

coastal North Carolina (USA) during a study of sea turtle population biology. Trawls were towed for 30 min, so turtles captured were forcibly submerged for < or = 30 min. Pound nets are passive gear in which fish and sea turtles are funneled into a concentrated area and removed periodically. Sea turtles in pound nets are free to surface and to feed at will. Blood was obtained from the dorsal cervical sinus as quickly as possible after landing on the boat (range 2-10 min trawl, 1-2 min pound net) and at 30 min after landing just prior to release. Blood gases including pH, partial pressures of O2 and CO2 (pO2, pCO2), and lactate were measured within 10 min. Instrument measurements for pH, pO2, and pCO2 made at 37 C were corrected to cloacal temperature and HCO3- was calculated from temperature-corrected pH and pCO2. Venous blood pH and bicarbonate were higher, and pO2 and lactate were lower from pound net-captured turtles compared to trawl captured turtles at the initial sampling time. In pound net turtles, pH and bicarbonate declined and lactate increased during 30 min on deck. In trawled sea turtles, venous blood pH increased and pCO2 and pO2 decreased during the 30 min on deck. Both capture systems caused perturbations in blood gas, acid-base, and lactate status, though alterations were greater in trawl captured turtles.

Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, wild, capture techniques, venous blood gases, lactates, acid-base.

Hicks, J.W. (2002). **The physiological and evolutionary significance of cardiovascular shunting patterns in reptiles.** *News in Physiological Sciences* 17: 241-245. ISSN: print: 0886-1714; online: 1522-161X.

Abstract: The morphology of the reptilian heart results in the mixing of oxygenated and deoxygenated blood (cardiac shunts). In birds and mammals cardiac shunts are detrimental, but in reptiles this condition is often considered a derived trait, conveying important physiological functions and favored by natural selection. Alternative views are advanced suggesting that, in reptiles, cardiac shunts represent either an ancestral condition or an embryonic trait.

Descriptors: reptiles, cardiovascular physiology, evolution, heart physiology, shunting patterns, significance, heart, blood.

Hochscheid, S., F. Bentivegna, and J.R. Speakman (2002). **Regional blood flow in sea turtles: implications for heat exchange in an aquatic ectotherm.** *Physiological and Biochemical Zoology* 75(1): 66-76. ISSN: 1522-2152.

NAL Call Number: QL1.P52

Abstract: Despite substantial knowledge on thermoregulation in reptiles, the mechanisms involved in heat exchange of sea turtles have not been investigated in detail. We studied blood flow in the front flippers of two green turtles, *Chelonia mydas*, and four loggerhead turtles, *Caretta caretta*, using Doppler ultrasound to assess the importance of regional blood flow in temperature regulation. Mean blood flow velocity and heart rate were determined for the water temperature at which the turtles were acclimated (19.3 degrees-22.5 degrees C) and for several experimental water temperatures (17 degrees-32 degrees C) to which the turtles were exposed for a short time. Flipper circulation increased with increasing water temperature, whereas during cooling, flipper circulation was greatly reduced. Heart rate was also positively correlated with water temperature; however, there were large variations between

individual heart rate responses. Body temperatures, which were additionally determined for the two green turtles and six loggerhead turtles, increased faster during heating than during cooling. Heating rates were positively correlated with the difference between acclimation and experimental temperature and negatively correlated with body mass. Our data suggest that by varying circulation of the front flippers, turtles are capable of either transporting heat quickly into the body or retaining heat inside the body, depending on the prevailing thermal demands.

Descriptors: reptiles, sea turtles, *Caretta caretta*, regional blood flow, heat exchange, implications, flipper blood flow, body temperatures.

Jackson, D.C. and J. Liu (2002). **The importance of blood flow for lactate uptake into shells of anoxic turtles**. *FASEB Journal* 16(4): A425. ISSN: 0892-6638.

NAL Call Number: QH301.F3

Descriptors: reptiles, turtles, anoxic, lactate uptake, blood flow, importance, meeting.

Notes: Meeting Information: Annual Meeting of the Professional Research Scientists on Experimental Biology, New Orleans, Louisiana, USA; April 20-24, 2002.

Kakizoe, Y., K. Sakaoka, F. Kakizoe, M. Yoshii, H. Nakamura, Y. Kanou, and I. Uchida (2007). **Successive changes of hematologic characteristics and plasma chemistry values of juvenile loggerhead turtles (*Caretta caretta*).** *Journal of Zoo and Wildlife Medicine* 38(1): 77-84. ISSN: 1042-7260.

Abstract: Hematologic characteristics and plasma chemistry values of juvenile loggerhead turtles (*Caretta caretta*) from the ages of 1 mo to 3 yr were obtained to establish baseline values. Five clinically normal loggerhead turtles were selected from the same clutch and raised in an indoor artificial nesting beach. Blood samples were successively collected and examined for various blood characteristics for a maximum total of 15 times. Hematologic characteristics, including packed cell volume, white blood cell counts, and white blood cell differentials; and plasma chemistry values, including total bilirubin, total protein, albumin, glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, gamma-glutamic transpeptidase, creatinine, blood urea nitrogen, uric acid, alkaline phosphatase, amylase, triglyceride, total cholesterol, ionized sodium, ionized potassium and ionized chlorine, were measured. These results were used to establish a hematology and blood chemistry baseline for captive juvenile loggerhead turtles and will aid in their medical management.

Descriptors: reptiles, loggerhead turtles, *Caretta caretta*, juvenile, hematologic characteristics, changes, plasma chemistry values, baseline values.

Keller, J.M., J.R. Kucklick, and P.D. McClellan Green (2004). **Organochlorine contaminants in loggerhead sea turtle blood: extraction techniques and distribution among plasma and red blood cells.** *Archives of Environmental Contamination and Toxicology* 46(2): 254-264. ISSN: 0090-4341.

NAL Call Number: TD172.A7

Descriptors: reptiles, sea turtle, *Caretta caretta*, organochlorine compounds, organochlorine pesticides, monitoring, blood plasma, erythrocytes, extraction techniques , plasma, red blood cells.

Knotek, Z., Z. Knotkova, J. Doubek, S. Pejrilova, and K. Hauptman (2003). **Plasma biochemistry in female green iguanas (*Iguana iguana*) with calcium metabolism disorders**. *Acta Veterinaria Brno* 72(2): 183-189. ISSN: 0001-7213.
Online: http://vfu-www.vfu.cz/acta-vet/vol72/183-03.htm
NAL Call Number: SF604.B7
Descriptors: reptiles, female green iguanas, *Iguana iguana*, plasma biochemistry, calcium metabolism disorders, diagnostic tool.
Language of Text: Czech.

Krosniunas, E.H. and J.W. Hicks (2003). **Cardiac output and shunt during voluntary activity at different temperatures in the turtle, *Trachemys scripta*.** *Physiological and Biochemical Zoology* 76(5): 679-694. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Red-eared slider turtles (*Trachemys scripta*) were chronically instrumented with blood flow probes for a long-term study of voluntary behavior in an enriched laboratory setting. Cardiovascular measures consisting of total cardiac output (Q(tot)), pulmonary blood flow (Q(pul)), systemic blood flow (Q(sys)), net cardiac shunt (Q(shunt)), heart rate (HR), and stroke volume (SV) were obtained during spontaneous activity at a constant body temperature (Tb=2 degrees C) and at unstable (variable) T(b)'s ranging from 19 degrees to 37 degrees C. The effects of temperature and activity differed between the pulmonary and systemic circuits, with increases in Q(sys) due to HR alone, while both HR and SV contributed to gains in Q(pul). At stable 20 degrees C, cardiovascular responses during diving, submerged swimming, and walking were qualitatively similar, and increases in Q(tot) during activity (approximately 2 x resting levels) were due to greater gains in Q(pul) than Q(sys). At unstable T(b)'s and in general, net Q(shunt) while active depended on the integration of individual physiological influences such as heating, cooling, and initial behavioral state acting on the cardiovascular system. During activity, net left-to-right (L-R) shunts predominated at constant T(b) of 20 degrees C (mean shunt fraction approximately 30%-40%), while both net L-R and right-to-left (R-L) shunts of varying size were found at unstable T(b)'s (19 degrees - 37 degrees C).
Descriptors: reptiles, turtle, *Trachemys scripta*, cardiac output, shunt, voluntary activity, different temperatures, body temperature, heart rate.

Kubalek, S., R. Mischke, and M. Fehr (2002). **Investigations on blood coagulation in the green iguana (*Iguana iguana*).** *Journal of Veterinary Medicine. A, Physiology, Pathology, Clinical Medicine* 49(4): 210-216. ISSN: 0931-184X.
NAL Call Number: 41.8 Z5
Abstract: The prothrombin time (PT), activated partial thromboplastin time (APTT), thrombin time, kaolin clotting time (KCT), dilute Russell's viper venom time (DRVVT) and reptilase time, as well as five different plasma fibrinogen assays [gravimetry, Jacobsson method (extinction at 280 nm), Millar method (heat precipitation), kinetic turbidometry, Clauss method] and resonance thrombography were performed in 26 clinically healthy green iguanas. All assays were carried out in comparison with pooled normal canine plasma. In iguana plasma, the PT [median (x0.50) = 453-831 s, dependent on the reagent], APTT

(x0.50 = 170-242 s, dependent on the reagent), thrombin time (x0.50 = 118 - > 1000 s, dependent on thrombin activity), KCT (x0.50 = 274 s), DRVVT (x0.50 = 349 s) and reptilase time (all samples > 1000 s) were widely scattered at the limit of measurability. Only fibrinogen concentrations measured using the Jacobsson method (x0.50 = 4.40 g/l) correlated well (r = 0.91) with gravimetry (x0.50 = 4.22 g/l). The results of this study indicate a limited suitability and a confined diagnostic significance of the selected methods in the green iguana. This may be caused by the species specificity of certain components of the reagents used, as well as a less optimal test system, i.e. relationship of test reagent to clotting factor concentrations in iguana plasma.
Descriptors: reptiles, green iguana, *Iguana iguana*, blood coagulation, investigations, prothrombin time, clotting factor, iguana plasma, thrombin time.

Litvinov, N. and S. Ganshchuk (2005). **Environment and body temperatures of reptiles in Volga-Ural region.** *Russian Journal of Herpetology* 12(Suppl.): 179-182. ISSN: 1026-2296.
Descriptors: reptiles, body temperature, environmental temperature, cardiovascular response, circulatory system, Eurasia, Volga Ural region.

Lopez Olvera, J.R., J. Montane, I. Marco, A. Martinez Silvestre, J. Soler, and S. Lavin (2003). **Effect of venipuncture site on hematologic and serum biochemical parameters in marginated tortoise (*Testudo marginata*)**. *Journal of Wildlife Diseases* 39(4): 830-836. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: reptiles, tortoise, *Testudo marginata*, venipuncture site, effect, hematologic parameters, serum biochemical parameters, marginated tortoise, blood samples.

Maginniss, L.A., S.A. Ekelund, and G.R. Ultsch (2004). **Blood oxygen transport in common map turtles during simulated hibernation.** *Physiological and Biochemical Zoology* 77(2): 232-241. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: We assessed the effects of cold and submergence on blood oxygen transport in common map turtles (*Graptemys geographica*). Winter animals were acclimated for 6-7 wk to one of three conditions at 3 degrees C: air breathing (AB-3 degrees C), normoxic submergence (NS-3 degrees C), and hypoxic (PO2=49 Torr) submergence (HS-3 degrees C). NS-3 degrees C turtles exhibited a respiratory alkalosis (pH 8.07; PCO2=7.9 Torr; [lactate]=2.2 mM) relative to AB-3 degrees C animals (pH 7.89; PCO2=13.4 Torr; [lactate]=1.1 mM). HS-3 degrees C animals experienced a profound metabolic acidosis (pH 7.30; PCO2=7.9 Torr; [lactate]=81 mM). NS-3 degrees C turtles exhibited an increased blood O2 capacity; however, isoelectric focusing revealed no seasonal changes in the isohemoglobin (isoHb) profile. Blood O2 affinity was significantly increased by cold acclimation; half-saturation pressures (P50's) for air-breathing turtles at 3 degrees and 22 degrees C were 6.5 and 18.8 Torr, respectively. P50's for winter animals submerged in normoxic and hypoxic water were 5.2 and 6.5 Torr, respectively. CO2 Bohr slopes (Delta logP50/Delta pH) were -0.15, -0.16, and -0.07 for AB-3 degrees C, NS-3 degrees C, and HS-3 degrees C turtles, respectively; the corresponding value for AB-22 degrees C was -0.37. The O2 equilibrium curve (O2EC)

shape was similar for AB-3 degrees C and NS-3 degrees C turtles; Hill plot n coefficients ranged from 1.8 to 2.0. The O2EC shape for HS-3 degrees C turtles was anomalous, exhibiting high O2 affinity below P50 and a right-shifted segment above half-saturation. We suggest that increases in Hb-O2 affinity and O2 capacity enhance extrapulmonary O2 uptake by turtles overwintering in normoxic water. The anomalous O2EC shape and reduced CO2 Bohr effect of HS-3 degrees C turtles may also promote some aerobic metabolism in hypoxic water.

Descriptors: reptiles, map turtles, blood oxygen transport, simulated hibernation, acclimatization, cold, hypothermia, oxygen blood, metabolism.

Martinez Silvestre, A., I. Marco, M.A. Rodriguez Dominguez, S. Lavin, and R. Cuenca (2005). **Morphology, cytochemical staining, and ultrastructural characteristics of the blood cells of the giant lizard of El Hierro (*Gallotia simonyi*).** *Research in Veterinary Science* 78(2): 127-134. ISSN: 0034-5288.

NAL Call Number: 41.8 R312

Abstract: The object of this study was to examine the erythrocytes, leukocytes and thrombocytes of the giant lizard (*Gallotia simonyi*) by light and electron (TEM) microscopy, and cytochemical staining. Smears were prepared from blood from the ventral coccygeal vein of 10 healthy adult lizards (five males and five females) from the Giant Lizard of El Hierro Reproduction and Research Centre, Canary Islands, Spain. The cytochemical stains used were: benzidine peroxidase (BP), chloroacetate esterase (CAE), alpha-naphthyl acetate esterase (ANAE), acid phosphatase (AP), periodic acid-Schiff (PAS), toluidine blue (TB) and May-Grunwald-Giemsa (MGG). Electron microscopy was also performed on all samples. Heterophils had granules that were heterogeneous in both size and electron density, and stained with BP, PAS and ANAE. Eosinophil granules were homogeneously electron-dense and stained for AP, CAE and ANAE. Basophils had both highly and moderately electron-dense granules, and stained with TB and ANAE. Azurophil granules were of low electron-density and stained for AP, CAE and ANAE. Azurophil cytoplasm was vacuolated on TEM. The cytoplasm of lymphocytes contained many ribosomes and was positive for AP. Monocytes had a large nucleus and a vacuolated cytoplasm but did not stain by any of the cytochemical methods used. Thrombocytes had a relatively large nucleus but little cytoplasm; they did not stain cytochemically. The blood cells of the giant lizards of El Hierro differ from those of other members of the Order Squamata both morphologically and cytochemically. The variation in cytochemical responses in the blood of reptiles makes it necessary to study species individually if meaningful clinical decisions are to be made.

Descriptors: giant lizard of El Hierro, *Gallotia simonyi*, blood cells, erythrocytes, leukocytes, thrombocytes, morphology, cytochemical staining, ultrastructural characteristics.

Martinez Silvestre, A., J.A. Mateo, and J. Pether (2003). **Electrocardiographic parameters in the Gomeran giant lizard, *Gallotia bravoana*.** *Journal of Herpetological Medicine and Surgery* 13(3): 22-25. ISSN: 1529-9651.

NAL Call Number: SF997.5.R4 B85

Descriptors: reptiles, Gomeran giant lizard, *Gallotia bravoana*, heart rate, electrocardiographic parameters.

Martinez Silvestre, A., M.A. Rodriguez Dominguez, J.A. Mateo, J. Pastor, I. Marco, S. Lavin, and R. Cuenca (2004). **Comparative haematology and blood chemistry of endangered lizards (*Gallotia* species) in the Canary Islands.** *Veterinary Record* 155(9): 266-269. ISSN: 0042-4900.

NAL Call Number: 41.8 V641

Abstract: Blood samples were taken from the ventral coccygeal vein of 15 El Hierro giant lizards (*Gallotia simonyi*) (seven females and eight males), six La Gomera giant lizards (*Gallotia bravoana*) (four males and two females) and four Tenerife giant lizards (*Gallotia intermedia*) (two males and two females), and 31 blood parameters were measured. Among the haematological parameters there were significant differences between the three species in heterophils, azurophils and lymphocytes, but no significant differences in red blood cell count, white blood cell count, haemoglobin, packed-cell volume, monocytes, eosinophils and basophils. In terms of blood chemistry there were significant differences between the three species in cholesterol, triglycerides, glucose, sodium, chloride, urea, uric acid, total proteins, prealbumin, albumin and gamma globulins, but no significant differences in calcium, potassium, aspartate aminotransferase, alanine aminotransferase, creatine kinase, bile acids, alpha-1 and alpha-2 globulins and beta globulins.

Descriptors: reptiles, endangered lizards, La Gomera giant lizards, *Gallotia* species, blood chemistry, comparative haematology, Hierro giant lizards, Tenerife giant lizards, blood parameters, Canary Islands.

Martinez Silvestre, A., J.L. Silva, and L. Silveira (2002). **Hematologia y bioquimica sanguinea del lagarto gigante de El Hierro (*Gallotia simonyi*) en cautividad. [Hematology and blood chemistry of captive El Hierro giant lizard (*Gallotia simonyi*).]**. *Revista Espanola De Herpetologia* 16: 5-10. ISSN: 0213-6686.

Descriptors: reptiles, giant lizard, *Gallotia simonyi*, blood chemistry, hematology, captive.

Language of Text: Spanish; Summary in English and Spanish.

Melo, M.B., S. Bordin, A.S.S. Duarte, S.H. Ogo, M.A. Torsoni, S.T.O. Saad, and F.F. Costa (2003). **Molecular characterization of hemoglobin alpha-D chains from *Geochelone carbonaria* and *Geochelone denticulata* land turtles.** *Comparative Biochemistry and Physiology Part B Biochemistry and Molecular Biology* 134(2): 389-395. ISSN: 1096-4959.

Abstract: In order to help elucidate the evolution of alpha-globins, the complete cDNA and amino acid sequences of *Geochelone carbonaria* and *Geochelone denticulata* land turtles alpha-D chains have been described. In *G. carbonaria*, the cDNA is 539 bp with ATG start codon located at position 46, TGA stop codon at position 469 and AATAAA polyadenylation signal at position 520. In *G. denticulata*, the cDNA is 536 bp with ATG start codon located at position 46, TGA stop codon at position 469 and AATAAA polyadenylation signal at position 517. Both cDNAs codify 141 amino acid residues, differing from each other in only four amino acid residues. When comparing with human Hb alpha-chain, alterations in important regions can be noted: alpha110 Ala-Gly, alpha114 Pro-Gly, alpha117 Phe-Tyr and alpha122 His-Gln. There is a high homology between the amino acids of these turtles when compared with chicken alpha-D chains, progressively decreasing when compared with human, crocodile, snake, frog and fish alpha-chains. Phylogenetic analysis of alpha-D chains

shows that those of turtles are closer to those of birds than to snakes and lizards.
Descriptors: reptiles, land turtles, *Geochelone carbonatia*, *Geochelone denticulata*, cDNA, amino acid sequences, birds , snakes, lizards, crocodiles.

Merchant, M. and A. Britton (2006). **Characterization of serum complement activity of saltwater (*Crocodylus porosus*) and freshwater (*Crocodylus johnstoni*) crocodiles.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 143(4): 488-493. ISSN: 1095-6433.
Abstract: We employed a spectroscopic assay, based on the hemolysis of sheep red blood cells (SRBCs), to assess the innate immune function of saltwater and freshwater crocodiles in vitro. Incubation of serum from freshwater and saltwater crocodiles with SRBCs resulted in concentration-dependent increases in SRBC hemolysis. The hemolytic activity occurred rapidly, with detectable activity within 2 min and maximum activity at 20 min. These activities, in both crocodilian species, were heat sensitive, unaffected by 20 mM methylamine, and completely inhibited by low concentrations of EDTA, suggesting that the alternative serum complement cascade is responsible for the observed effects. The hemolytic activities of the sera were inhibited by other chelators of divalent metal ions, such as phosphate and citrate. The inhibition of SRBC hemolysis by EDTA could be completely restored by the addition of 10 mM Ca2+ or Mg2+, but not Ba2+, Cu2+ or Fe2+, indicating specificity for these metal ions. The serum complement activities of both crocodilians were temperature-dependent, with peak activities occurring at 25-30 degrees C and reduced activities below 25 degrees C and above 35 degrees C.
Descriptors: reptiles, saltwater (*Crocodylus porosus*) and freshwater (*Crocodylus johnstoni*) crocodiles, crocodiles blood, complement system proteins metabolism, barium pharmacology, calcium pharmacology, copper pharmacology, edetic acid pharmacology, erythrocytes metabolism, fresh water, hemolysis drug effects, iron pharmacology, kinetics, magnesium pharmacology, temperature.

Metin, K., O. Turkozan, F. Kargin, Y. Basimoglu Koca, E. Taskavak, and S. Koca (2006). **Blood cell morphology and plasma biochemistry of the captive European pond turtle *Emys orbicularis*.** *Acta Veterinaria Brno* 75(1): 49-55. ISSN: 0001-7213.
Online: http://dx.doi.org/10.2754/avb200675010049
NAL Call Number: SF604.B7
Descriptors: reptiles, European pond turtle, *Emys orbicularis*, blood cell morphology, plasma biochemistry, captive, micronucleated erythrocytes.
Language of Text: Czech; English.

Munns, S.L., L.K. Hartzler, A.F. Bennett, and J.W. Hicks (2005). **Terrestrial locomotion does not constrain venous return in the American alligator, *Alligator mississippiensis*.** *Journal of Experimental Biology* 208(17): 3331-3339. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01758
NAL Call Number: 442.8 B77
Descriptors: reptiles, American alligator, *Alligator mississippiensis*, terrestrial locomotion, does not constrain, venous return.

Overgaard, J., H. Gesser, and T. Wang (2007). **Tribute to P. L. Lutz: Cardiac performance and cardiovascular regulation during anoxia/hypoxia in freshwater turtles.** *Journal of Experimental Biology* 210(Pt 10): 1687-1699. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.001925
NAL Call Number: 442.8 B77
Abstract: Freshwater turtles overwintering in ice-covered ponds in North America may be exposed to prolonged anoxia, and survive this hostile environment by metabolic depression. Here, we review their cardiovascular function and regulation, with particular emphasis on the factors limiting cardiac performance. The pronounced anoxia tolerance of the turtle heart is based on the ability to match energy consumption with the low anaerobic ATP production during anoxia. Together with a well-developed temporal and spatial energy buffering by creatine kinase, this allows for cellular energy charge to remain high during anoxia. Furthermore, the turtle heart is well adapted to handle the adverse effects of free phosphate arising when phosphocreatine stores are used. Anoxia causes tenfold reductions in heart rate and blood flows that match the metabolic depression, and blood pressure is largely maintained through increased systemic vascular resistance. Depression of the heart rate is not driven by the autonomic nervous system and seems to arise from direct effects of oxygen lack and the associated hyperkalaemia and acidosis on the cardiac pacemaker. These intra- and extracellular changes also affect cardiac contractility, and both acidosis and hyperkalaemia severely depress cardiac contractility. However, increased levels of adrenaline and calcium may, at least partially, salvage cardiac function under prolonged periods of anoxia.
Descriptors: reptiles, freshwater turtles, cardiac performance, cardiovascular regulation, anoxia, hypoxia, heart, blood flow.

Overgaard, J., J.A. Stecyk, A.P. Farrell, and T. Wang (2002). **Adrenergic control of the cardiovascular system in the turtle *Trachemys scripta*.** *Journal of Experimental Biology* 205(Pt 21): 3335-3345. ISSN: 0022-0949.
NAL Call Number: 442.8 B77
Abstract: Freshwater turtles, *Trachemys scripta*, like all non-crocodilian reptiles, are able to shunt blood between the pulmonary and systemic circulations owing to their undivided ventricle. The prevailing hypothesis is that the ratio of pulmonary and systemic resistances is the primary determinant of cardiac shunting in turtles. In the present study, we have examined the adrenergic influences on vascular resistances in the pulmonary and systemic circulations and the associated effects on cardiac shunts in turtles. To achieve this objective, systemic blood flow and pressures and pulmonary blood flow and pressures were measured simultaneously in anaesthetised turtles during bolus injections of alpha- and beta-adrenergic agonists and antagonists. Total cardiac output, systemic vascular resistance, pulmonary vascular resistance, heart rate and cardiac stroke volume were derived from these measurements. Anaesthetised turtles showed cardiovascular characteristics that were similar to those of non-apnoeic non-anaesthetised turtles, because anaesthesia blocked the cholinergically mediated constriction of the pulmonary artery that is normally associated with apnoea. As a result, the anaesthetised turtles exhibited a large net left-to-right shunt, and the adrenergic responses could be observed without confounding changes resulting from apnoea. Potent alpha-adrenergic vasoconstriction and weaker beta-adrenergic vasodilation were discovered in the

systemic circulation. Modest beta-adrenergic vasodilation and possible weak alpha-adrenergic vasodilation were discovered in the pulmonary circulation. This adrenergically mediated vasoactivity produced the largest range of cardiac shunts observed so far in turtles. Regression analysis revealed that 97% of the variability in the cardiac shunts could be accounted for by the ratio of the pulmonary and systemic resistances. Thus, we conclude that, independent of whether the pulmonary vascular resistance is modulated (as during apnoea) or the systemic resistance is modulated with adrenergic mechanisms (as shown here), the consequences on the cardiac shunt patterns are the same because they are determined primarily by the ratios of the pulmonary and systemic resistance.
Descriptors: reptiles, freshwater turtles, *Trachemys scripta*, cardiovascular system, andrenergic control, blood, cardiac shunts, undivided ventricle, cardiac output, stroke volume, heart rate.

Pejrilova, S., Z. Knotkova, Z. Knotek, and V. Vrbas (2004). **Age-related changes of the haematological profile in green iguana (*Iguana iguana rhinolopha*)**. *Acta Veterinaria Brno* 73(3): 305-312. ISSN: 0001-7213.
Online: http://vfu-www.vfu.cz/acta-vet/vol73/73-305.pdf
NAL Call Number: SF604.B7
Descriptors: reptiles, green iguana, *Iguana iguana rhinolopha*, hematological profile, age related changes, blood sample taking, red blood cell counts, white blood cell counts, hemoglobin concentration, mean corpuscular volume.

Pendl, H. (2006). **Morphologic changes in red blood cells of brids [birds] and reptiles and their interpretation.** *Israel Journal of Veterinary Medicine* 61(1): 2-11. ISSN: 0334-9152.
Online: http://www.isrvma.org/article/61_1_1.htm
NAL Call Number: 41.8 R25
Descriptors: reptiles, red blood cells, morphologic changes, birds, reptiles, interpretation, packed cell volume.

Porges, S.W., T.C. Riniolo, T. McBride, and B. Campbell (2003). **Heart rate and respiration in reptiles: contrasts between a sit-and-wait predator and an intensive forager.** *Brain and Cognition* 52(1): 88-96. ISSN: print: 0278-2626; online: 1090-2147.
Abstract: The current study investigated respiration and heart rate in two species of reptiles with distinct behavioral strategies: (1) the Sudan plated lizard (*Gerrhosaurus major*), a sit-and-wait predator; and (2) the Savanna monitor (*Varanus exanthematicus*), an intensive forager. It was hypothesized that (a) the plated lizard would not express respiratory sinus arrhythmia, and (b) the monitor, a reptile with behavioral and physiological characteristics similar to mammals, might express respiratory sinus arrhythmia, a pattern previously observed only in mammals. The data demonstrated that although there were strong vagal influences on the heart, respiratory activity was not manifested in the heart rate pattern of the plated lizards. In contrast, the monitor exhibited a reliable ventilatory influence on the heart rate pattern, although the pattern differed from the respiratory sinus arrhythmia observed in mammals. Consistent with the Polyvagal Theory (), the vagal control of the reptilian heart in both species appears to be mediated through the phylogenetically older unmyelinated system, a

system that evolved to support metabolic conservation and not social behavior.
Descriptors: reptiles, Sudan plated lizard (*Gerrhosaurus major*), Savanna monitor (*Varanus exanthematicus*), heart rate, respiration, sinus arrhythmia, heart rate pattern, vagal control.

Sano Martins, I.S., Z. Dabrowski, Z. Tabarowski, E. Witkowska Pelc, D.D. Spadacci Morena, and K. Spodaryk (2002). **Haematopoiesis and a new mechanism for the release of mature blood cells from the bone marrow into the circulation in snakes (Ophidia).** *Cell and Tissue Research* 310(1): 67-75. ISSN: 0302-766X.
NAL Call Number: QH581.A1Z4
Abstract: This is the first description of haematopoiesis in snakes. Studies were carried out on the following species belonging to Ophidia: *Bothrops jararaca*, *Bothrops jararacusu*, *Waglerophis merremii*, *Elaphe taeniura taeniura*, B*oa constrictor*,and *Python reticulatus*. Smears of the peripheral blood and histological preparations from the vertebrae, ribs, liver, and spleen were studied under a light and electron microscope. Myeloid cells were present in the following locations in the vertebrae: the neural spine, zygoapophysial processes, floor of the neural canal, lacunae in the bodies of vertebrae and also inside the ribs. Although the vascular system was well developed, especially around the ribs, vessels inside the marrow cavities were scarce, both in the ribs and elsewhere where haematopoiesis was found. Venous sinuses were well developed in the vertebrae and in the rib regions from their costal head towards the middle area. They consisted of one layer of fine endothelial cells. Mature cells in the process of migration into the general circulation were only sporadically encountered when venous sinuses were studied on perfusion-fixed specimens. In contrast, almost every sinus venosus contained protrusions directed towards the lumen, filled mostly with mature and immature blood cells. Various stages of their formation were seen in the cross sections of venous sinuses ranging from small, newly formed to large, elongated ones, filled with many fully developed and some maturing blood cells. In many cases the apices of the protrusions were ruptured, and mature blood cells, as well as a few immature ones, were seen in their vicinity. This observation led us to a new hypothesis that blood cells are released from the extravascular space into the lumen of venous sinuses. In snakes, these cells are released into the systemic circulation mainly via the rupture of protrusions filled with mature blood cells and, to a lesser degree, by transcytosis as known in mammals. In the spleens from young specimens, 1-2 foci of haematopoiesis were encountered where lymphopoiesis predominated. Haematopoiesis was not detected in the liver.
Descriptors: reptiles, snakes, hematopoiesis, mature blood cells, bone marrow, new mechanism, peripheral blood smears, myeloid cells.

Santos, A.L.Q., T.S. Malta, A.V. Mundim, J.R.F. Alves Junior, and S.F.M. Carvalho (2005). **Variacao dos constituintes bioquimicos sanguineos de Tartarguas-da-Amazonia (*Podocnemis expansa*, Schweigger - 1812) (Testudinata) mantidas em criatorio comercial. [Blood biochemistry rates of South American river turtle (*Podocnemis expansa*, Schweigger - 1812) (Testudinata) bred in captivity.]**. *Archives of Veterinary Science* 10(3): 1-8. ISSN: 1517-784X.
Abstract: T
Descriptors: reptiles, South American river turtle, *Podocnemis expansa*, blood biochemistry

rates, bred in captivity.
Language of Text: Portuguese; Summary in English and Portuguese.

Seebacher, F. and C.E. Franklin (2005). **Cardiovascular mechanisms during thermoregulation in reptiles.** In: *Animals and Environments: Proceedings of the Third International Conference of Comparative Physiology and Biochemistry,August 7, 2004-August 13, 2004, KwaZulu-Natal, South Africa,* International Congress Series, 0531-5131, Elsevier: Amsterdam, p. 242-249. ISBN: 0444517634.
NAL Call Number: QP82 .I58 2004
Descriptors: reptiles, thermoregulation, cardiovascular mechanisms.

Seymour, R.S. and J.O. Arndt (2004). **Independent effects of heart-head distance and caudal blood pooling on blood pressure regulation in aquatic and terrestrial snakes.** *Journal of Experimental Biology.* 207(Pt 8): 1305-1311. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.00882
NAL Call Number: 442.8 B77
Abstract: Changes in orientation in a gravitational field markedly alter the patterns of blood pressure and flow in animals, especially tall or long ones such as giraffes or snakes. Vertical orientation tends to reduce blood flow and pressure in the head for two major reasons. First, the increased vertical blood column above the heart creates a gravitational hydrostatic pressure against which the heart must work. Second, expansion of dependent vessels in the lower extremities causes blood pooling and reduces return of venous blood to the heart, thereby lowering flow and pressure. For most animals, it is difficult to separate these two effects, but snakes offer the possibility of bending the animal in the region of the heart and manipulating the two ends of the body independently. We studied baroregulatory responses in terrestrial pythons (*Liasis fuscus*) and aquatic file snakes (*Acrochordus arafurae*) by tilting only the front or rear parts and then the whole animal. Changes in head blood pressure during partial tilts added up to the change during full tilt. The vertical distance to the head had twice as much influence on head blood pressure than did blood pooling in the pythons and four times as much in file snakes. This accounts for the cephalad location of the heart in terrestrial species compared with aquatic ones.
Descriptors: reptiles, snakes, heart-head distance, caudal blood pooling, blood pressure regulation, gravitational field, head blood pressure.

Silva, E.O., J.P. Diniz, S. Alberio, R. Lainson, W. de Souza, and R.A. DaMatta (2004). **Blood monocyte alteration caused by a hematozoan infection in the lizard *Ameiva ameiva* (Reptilia: Teiidae).** *Parasitology Research* 93(6): 448-456. ISSN: 0932-0113.
NAL Call Number: QL757.P377
Abstract: Although hematozoa have been described from many different host species, little is known about the infection and its relationship to the physiology of the host. We studied a hematozoan, regarded as a species of *Lainsonia Landau*, 1973 (Lankestereliidae), which infects the monocytes of the lizard *Ameiva ameiva*. The infected animals show a huge monocytosis and morphological changes in the monocytes. Ultrastructurally, the parasite has an apical complex, dense bodies, electron lucent structures, plasma membrane projections

and folding which may be involved with nutrition. The parasite occupies a parasitophorous vacuole (PV) exhibiting high electron density at its membrane. Mitochondria and the Golgi complex of the monocytes were concentrated around the PV, and the cytoplasm was totally occupied by a vimentin type of intermediate filament radiating from (or to) the cytosolic surface of the PV. Vimentin was identified by diameter measurement, immunofluorescence and immunoelectron microscopy. These observations indicate that this infection alters the physiological state of the host and suggest that this parasite has the ability to modify monocyte vimentin assembly.
Descriptors: reptiles, lizard, *Ameiva ameiva*, parasites, hematozoan, lizard, blood monocyte, alteration, infection, monocytosis.

Skovgaard, N., A.S. Abe, D.V. Andrade, and T. Wang (2005). **Hypoxic pulmonary vasoconstriction in reptiles: a comparative study of four species with different lung structures and pulmonary blood pressures.** *American Journal of Physiology. Regulatory, Integrative and Comparative Physiology* 289(5): R1280-R1288. ISSN: print: 0363-6119; online: 1522-1490.
Online: http://dx.doi.org/10.1152/ajpregu.00200.2005
Abstract: Low O2 levels in the lungs of birds and mammals cause constriction of the pulmonary vasculature that elevates resistance to pulmonary blood flow and increases pulmonary blood pressure. This hypoxic pulmonary vasoconstriction (HPV) diverts pulmonary blood flow from poorly ventilated and hypoxic areas of the lung to more well-ventilated parts and is considered important for the local matching of ventilation to blood perfusion. In the present study, the effects of acute hypoxia on pulmonary and systemic blood flows and pressures were measured in four species of anesthetized reptiles with diverse lung structures and heart morphologies: varanid lizards (*Varanus exanthematicus*), caimans (*Caiman latirostris*), rattlesnakes (*Crotalus durissus*), and tegu lizards (*Tupinambis merianae*). As previously shown in turtles, hypoxia causes a reversible constriction of the pulmonary vasculature in varanids and caimans, decreasing pulmonary vascular conductance by 37 and 31%, respectively. These three species possess complex multicameral lungs, and it is likely that HPV would aid to secure ventilation-perfusion homogeneity. There was no HPV in rattlesnakes, which have structurally simple lungs where local ventilation-perfusion inhomogeneities are less likely to occur. However, tegu lizards, which also have simple unicameral lungs, did exhibit HPV, decreasing pulmonary vascular conductance by 32%, albeit at a lower threshold than varanids and caimans (6.2 kPa oxygen in inspired air vs. 8.2 and 13.9 kPa, respectively). Although these observations suggest that HPV is more pronounced in species with complex lungs and functionally divided hearts, it is also clear that other components are involved.
Descriptors: lizards, *Varanus exanthematicus*, *Tupinambis merianae*, caimans, *Caiman latirostris*, rattlesnakes, *Crotalus durissus*, lung structures, hypoxic pulmonary vasoconstriction, blood pressures, 02 levels, HPV.

Skovgaard, N., G. Galli, A. Abe, E.W. Taylor, and T. Wang (2005). **The role of nitric oxide in regulation of the cardiovascular system in reptiles.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 142(2): 205-214. ISSN: 1095-6433.
Abstract: The roles that nitric oxide (NO) plays in the cardiovascular system of reptiles are reviewed, with particular emphasis on its effects on central vascular blood flows in the

systemic and pulmonary circulations. New data is presented that describes the effects on hemodynamic variables in varanid lizards of exogenously administered NO via the nitric oxide donor sodium nitroprusside (SNP) and inhibition of nitric oxide synthase (NOS) by l-nitroarginine methyl ester (l-NAME). Furthermore, preliminary data on the effects of SNP on hemodynamic variables in the tegu lizard are presented. The findings are compared with previously published data from our laboratory on three other species of reptiles: pythons (), rattlesnakes () and turtles (). These five species of reptiles possess different combinations of division of the heart and structural complexity of the lungs. Comparison of their responses to NO donors and NOS inhibitors may reveal whether the potential contribution of NO to vascular tone correlates with pulmonary complexity and/or with blood pressure. All existing studies on reptiles have clearly established a potential role for NO in regulating vascular tone in the systemic circulation and NO may be important for maintaining basal systemic vascular tone in varanid lizards, pythons and turtles, through a continuous release of NO. In contrast, the pulmonary circulation is less responsive to NO donors or NOS inhibitors, and it was only in pythons and varanid lizards that the lungs responded to SNP. Both species have a functionally separated heart, so it is possible that NO may exert a larger role in species with low pulmonary blood pressures, irrespective of lung complexity.
Descriptors: reptiles, nitric oxide, NO, cardiovascular system, roles, regulation, systemic circulation, pulmonary circulation, blood pressure.

Skovgaard, N., D.E. Warren, D.C. Jackson, and T. Wang (2005). **Endothelin-1 causes systemic vasodilatation in anaesthetised turtles (*Trachemys scripta*) through activation of ETB-receptors.** *Journal of Experimental Biology.* 208(Pt 19): 3739-3746. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01834
NAL Call Number: 442.8 B77
Abstract: The effects of endothelin-1 (ET-1) on systemic and pulmonary circulation were investigated in anaesthetised freshwater turtles (*Trachemys scripta*) instrumented with arterial catheters and blood flow probes. Bolus intra-arterial injections of ET-1 (0.4-400 pmol kg(-1)) caused a dose-dependent systemic vasodilatation that was associated with a decrease in systemic pressure (P(sys)) and a rise in systemic blood flow (Q(sys)), causing systemic conductance (G(sys)) to increase. ET-1 had no significant effects on the pulmonary vasculature, heart rate (fh) or total stroke volume (Vs(tot)). This response differs markedly from mammals, where ET-1 causes an initial vasodilatation that is followed by a pronounced pressor response. In mammals, the initial dilatation is caused by stimulation of ET(B)-receptors, while the subsequent constriction is mediated by ET(A)-receptors. In the turtles, infusion of the ET(B)-receptor agonist BQ-3020 (150 pmol kg(-1)) elicited haemodynamic changes that were similar to those of ET-1, and the effects of ET-1 were not affected by the ET(A)-antagonist BQ-610 (0.15 micromol kg(-1)). Conversely, all effects of ET-1 were virtually abolished after specific ET(B)-receptor blockade with the ET(B)-antagonist BQ-788 (0.15 micromol kg(-1)). The subsequent treatment with the general ET-receptor antagonist tezosentan (15.4 micromol kg(-1)) did not produce effects that differed from the treatment with ET(B)-antagonist, and the blockade of ET-1 responses persisted. This present study indicates, therefore, that ET(B)-receptors are responsible for the majority of the cardiovascular responses to ET-1 in Trachemys.

Descriptors: turtles, *Trachemys scripta*, anesthetised, systemic vasodilatation, blood flow, endothelin-1 , pulmonary circulation, ETB recptors.

Skovgaard, N. and T. Wang (2006). **Local control of pulmonary blood flow and lung structure in reptiles: implications for ventilation perfusion matching**. *Respiratory Physiology and Neurobiology* 154(1-2): 107-117. ISSN: 1569-9048.
NAL Call Number: QP121.A1 R4
Descriptors: reptiles, pulmonary blood flow, local control, lung structure, ventilation perfusion matching, implications, chambered lungs.

Soslau, G., P.J. Prest, R. Class, R. George, F. Paladino, and G. Violetta (2005). **Comparison of sea turtle thrombocyte aggregation to human platelet aggregation in whole blood.** *Comparative Biochemistry and Physiology. Part B, Biochemistry and Molecular Biology* 142(3): 353-360. ISSN: 1096-4959.
Abstract: The endangered sea turtles are living "fossils" that afford us an opportunity to study the hemostatic process as it likely existed millions of years ago. There are essentially no data about turtle thrombocyte aggregation prior to our studies. Thrombocytes are nucleated cells that serve the same hemostatic functions as the anucleated mammalian platelet. Sea turtle thrombocytes aggregate in response to collagen and beta-thrombin. Ristocetin induces an agglutination/aggregation response indicating the presence of a von Willebrand-like receptor, GPIb, found in all mammalian platelets. Samples treated with alpha-thrombin plus gamma-thrombin followed by ristocetin results in a rapid, stronger response than ristocetin alone. These responses are inhibited by the RGDS peptide that blocks fibrinogen cross-linking of mammalian platelets via the fibrinogen receptor, GPIIb/IIIa. Three platelet-like proteins, GPIb, GPIIb/IIIa and P-selection are detected in sea turtle thrombocytes by fluorescence activated cell sorting. Turtle thrombocytes do not respond to ADP, epinephrine, serotonin, thromboxane A2 mimetic, U46619, trypsin, or alpha-thrombin and gamma-thrombin added alone. Comparison of hemostasis in sea turtles to other vertebrates could provide a framework for understanding the structure/function and evolution of these pathways and their individual components.
Descriptors: sea turtle, thrombocyte aggregation, human platelet aggregation, whole blood, comparison, hemostatic functions.

Soslau, G., D.A. Morgan, R. Class, F.V. Paladino, R. George, B. Whitaker, G.C. Violetta, S.J. Goldenberg, and J.R. Spotila (2003). **Coagulatin and platelet aggregation in sea turtles.** *NOAA Technical Memorandum NMFS SEFSC* 503: 306-307.
Descriptors: reptiles, sea turtles, coagulation, platelet aggregation, cardiovascular , blood.

Southwood, A.L., C.A. Darveau, and D.R. Jones (2003). **Metabolic and cardiovascular adjustments of juvenile green turtles to seasonal changes in temperature and photoperiod.** *Journal of Experimental Biology* 206(24): 4521-4531. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.00689
NAL Call Number: 442.8 B77

Descriptors: repetiles, juvenile green turtles, temperature changes, photoperiod, metabolic, cardiovascular, adjustments.

Stawski, C.Y., G.C. Grigg, D.T. Booth, and L.A. Beard (2006). **Temperature and the respiratory properties of whole blood in two reptiles, *Pogona barbata* and *Emydura signata.*** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 143(2): 173-183. ISSN: 1095-6433.

Abstract: We investigated the capacity of two reptiles, an agamid lizard *Pogona barbata* and a chelid turtle *Emydura signat*a, to compensate for the effects of temperature by making changes in their whole blood respiratory properties. This was accomplished by measuring the P50 (at 10, 20 and 30 degrees C), hematocrit (Hct), haemoglobin concentration ([Hb]) and mean cell haemoglobin concentration (MCHC) in field acclimatised and laboratory acclimated individuals. The acute effect of temperature on P50 in *P. barbata*, expressed as heat of oxygenation (deltaH), ranged from -16.8+/-1.84 to -28.5+/-2.73 kJ/mole. P50 of field acclimatised *P. barbata* increased significantly from early spring to summer at the test temperatures of 20 degrees C (43.1+/-1.2 to 48.8+/-2.1 mmHg) and 30 degrees C (54.7+/-1.2 to 65.2+/-2.3 mmHg), but showed no acclimation under laboratory conditions. For *E. signata*, deltaH ranged from -31.1+/-6.32 to -48.2+/-3.59 kJ/mole. Field acclimatisation and laboratory acclimation of P50 did not occur. However, in *E. signata*, there was a significant increase in [Hb] and MCHC from early spring to summer in turtles collected from the wild (1.0+/-0.1 to 1.7+/-0.2 mmol/L and 4.0+/-0.3 to 6.7+/-0.7 mmol/L, respectively).

Descriptors: reptiles, turtle, *Emydura signata*, lizard, *Pogona barbata*, temperature, respiratory properties, whole blood, acclimation.

Stecyk, J.A. and A.P. Farrell (2007). **Effects of extracellular changes on spontaneous heart rate of normoxia- and anoxia-acclimated turtles (*Trachemys scripta*).** *Journal of Experimental Biology* 210(Pt 3): 421-431. ISSN: 0022-0949.

Online: http://dx.doi.org/10.1242/jeb.02653

NAL Call Number: 442.8 B77

Abstract: Heart rate (f(H)) of the anoxia-tolerant freshwater turtle (*Trachemys scripta*) during prolonged anoxia exposure is 2.5- to 5-times lower than the normoxic rate, but whether alterations in blood composition that accompany prolonged anoxia contribute to this bradycardia is unknown. We examined how temperature acclimation, oxygen deprivation, acidosis, hyperkalemia, hypercalcemia and adrenaline affect chronotropy in the turtle myocardium. We monitored spontaneous contraction rates of right-atrial preparations obtained from 21 degrees C- and 5 degrees C-acclimated turtles that had been exposed to either normoxia or anoxia (6 h at 21 degrees C; 2 weeks at 5 degrees C). Sequential exposures to saline solutions were designed to mimic, in a step-wise manner, the shift from a normoxic to anoxic extracellular condition (for normoxia-acclimated preparations) or the reverse (for anoxia-acclimated preparations). Our results clearly show that prolonged anoxia exposure re-sets the intrinsic f(H) of turtles at both temperatures, with reductions in intrinsic f(H) in the range of 25%-53% compared with normoxia. This intrinsic change would contribute to the bradycardia observed with prolonged anoxia. Further, we found negative chronotropic effects of extracellular anoxia, acidosis and hyperkalemia, and positive chronotropic effects of hypercal-

cemia and adrenaline. The exact nature of these extracellular effects depended, however, on the acclimation temperature and the prior exposure of the animal to anoxia. With normoxia-acclimated preparations at 21 degrees C, combined anoxia and acidosis (pH reduced from approximately 7.8 to approximately 7.2) significantly reduced spontaneous f(H) by 22% and subsequent exposure to hyperkalemia (3.5 mmol l(-1)K(+)) further decreased f(H). These negative chronotropic effects were ameliorated by increasing the adrenaline concentration from the tonic level of 1 nmol l(-1) to 60 nmol l(-1). However, in anoxia-acclimated preparations at 21 degrees C, anoxia alone inhibited f(H) (by approximately 30%). This negative chronotropic effect was counteracted by both hypercalcemia (6 mmol l(-1) Ca(2+)) and adrenaline (60 nmol l(-1)). At 5 degrees C, only the combination of anoxia, acidosis (pH reduced from approximately 8.0 to approximately 7.5) and hyperkalemia (3.5 mmol l(-1) K(+)) significantly reduced spontaneous f(H) (by 23%) with preparations from normoxia-acclimated turtles. This negative chronotropic effect was fully reversed by hypercalcemia (10 mmol l(-1) Ca(2+)). By contrast, spontaneous f(H) of anoxia-acclimated preparations at 5 degrees C was not affected by any of the extracellular changes. We conclude that prior temperature and anoxia experiences are central to determining f(H) during prolonged anoxia in *Trachemys scripta* both as a result of the re-setting of pacemaker rhythm and through the potential influence of extracellular changes.
Descriptors: reptiles, freshwater turtle, *Trachemys scripta*, extracellular changes, effect, spontaneous heart rate, normoxia, anoxia, bradycardia.

Toney, V.I. and D.C. Jackson (2003). **Cardiovascular effects of graded hypoxia and graded acidosis on the myocardium of the western painted turtle.** *FASEB Journal* 17(4-5): Abstract No. 313.5. ISSN: 0892-6638.
NAL Call Number: QH301.F3
Descriptors: reptiles, painted turtle, graded hypoxia, acidosis myocardium, cardiovascular, effects, meeting.
Notes: Meeting Information: FASEB Meeting on Experimental Biology: Translating the Genome, San Diego, CA, USA; April 11-15, 2003.

Toney, V.I. and D.C. Jackson (2002). **Cardiovascular effects of graded hypoxia on the myocardium of the western painted turtle**. *FASEB Journal* 16(5): A887. ISSN: 0892-6638.
NAL Call Number: QH301.F3
Descriptors: reptiles, painted turtle, graded hypoxia, effects, myocardium, cardiovascular, effects, meeting abstracts.
Notes: Meeting Information: Annual Meeting of Professional Research Scientists on Experimental Biology, New Orleans, Louisiana, USA; April 20-24, 2002.

Voituron, Y., J.M. Storey, C. Grenot, and K.B. Storey (2002). **Freezing survival, body ice content and blood composition of the freeze-tolerant European common lizard, *Lacerta vivipara*.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 172(1): 71-76. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: To investigate the freeze tolerance of the European common lizard, *Lacerta*

vivipara, we froze 17 individuals to body temperatures as low as -4 degrees C under controlled laboratory conditions. The data show that this species tolerates the freezing of 50% of total body water and can survive freezing exposures of at least 24-h duration. Currently, this represents the best known development of freeze tolerance among squamate reptiles. Freezing stimulated a significant increase in blood glucose levels (16.15+/- 1.73 micromol x ml(-1) for controls versus 25.06 +/- 2.92 micromol x ml(-1) after thawing) but this increase had no significant effect on serum osmolality which was unchanged between control and freeze-exposed lizards (506.0 +/- 23.8 mosmol x l(-1) versus 501.0 +/- 25.3 mosmol x l(-1), respectively). Tests that assessed the possible presence of antifreeze proteins in lizard blood were negative. Recovery at 5 degrees C after freezing was assessed by measurements of the mean time for the return of breathing (5.9 +/- 0.5 h) and of the righting reflex (44.8 +/- 4.5 h). Because this species hibernates in wet substrates inoculative freezing may frequently occur in nature and the substantial freeze tolerance of this lizard should play a key role in its winter survival.
Descriptors: reptiles, European common lizard, *Lacerta vivipara*, freezing survival, body ice, blood composition, freeze tolerant, serum osmolality, breathing.

Zaar, M., E. Larsen, and T. Wang (2004). **Hysteresis of heart rate and heat exchange of fasting and postprandial savannah monitor lizards (*Varanus exanthematicus*).** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 137(4): 675-682. ISSN: 1095-6433.
Abstract: Reptiles are ectothermic, but regulate body temperatures (T(b)) by behavioural and physiological means. Body temperature has profound effects on virtually all physiological functions. It is well known that heating occurs faster than cooling, which seems to correlate with changes in cutaneous perfusion. Increased cutaneous perfusion, and hence elevated cardiac output, during heating is reflected in an increased heart rate (f(H)), and f(H), at a given T(b), is normally higher during heating compared to cooling ('hysteresis of heart rate'). Digestion is associated with an increased metabolic rate. This is associated with an elevated f(H) and many species of reptiles also exhibited a behavioural selection of higher T(b) during digestion. Here, we examine whether digestion affects the rate of heating and cooling as well as the hysteresis of heart rate in savannah monitor lizards (*Varanus exanthematicus*). Fasting lizards were studied after 5 days of food deprivation while digesting lizards were studied approximately 24 h after ingesting dead mice that equalled 10% of their body mass. Heart rate was measured while T(b) increased from 28 to 38 degrees C under a heat lamp and while T(b) decreased during a subsequent cooling phase. The lizards exhibited hysteresis of heart rate, and heating occurred faster than cooling. Feeding led to an increased f(H) (approximately 20 min(-1) irrespective of T(b)), but did not affect the rate of temperature change during heating or cooling. Therefore, it is likely that the increased blood flows during digestion are distributed exclusively to visceral organs and that the thermal conductance remains unaffected by the elevated metabolic rate during digestion.
Descriptors: reptiles, savannah monitor lizards, *Varanus exanthematicus*, heart rate, heat exchange, fasting, post prandial, body temperature, digestion, cardiac output, heating, cooling.

Diet, Nutrition and Metabolism

Akani, G.C., E.A. Eniang, I.J. Ekpo, F.M. Angelici, and L. Luiselli (2003). **Food habits of the snake *Psammophis phillipsi* from the continuous rain-forest region of southern nigeria (west africa).** *Journal of Herpetology* 37(1): 208-211. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: reptiles, snake, *Psammophis phillipsi*, food habits, rain forest region, lizards, small mammals, southern Nigeria.

Andrade, D.V., A.P. Cruz Neto, A.S. Abe and T. Wang (2005). **Specific dynamic action in ectothermic vertebrates: A review of determinants of postprandial metabolic response in fishes, amphibians, and reptiles.** In: J.M.W.T. Starck (Editors), *Physiological and Ecological Adaptations to Feeding in Vertebrates.,* Science Publishers, Inc.: Enfield, NH, p. 305-324. ISBN: 1578082463.
NAL Call Number: QP145 .P46 2005
Descriptors: amphibians, fish, reptiles, determinants of postprandial metabolic response, digestion.

Angilletta, M.J.J., V. Lee, and A.C. Silva (2006). **Energetics of lizard embryos are not canalized by thermal acclimation.** *Physiological and Biochemical Zoology* 79(3): 573-580. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: In some species of ectotherms, temperature has little or no effect on the amount of energy expended during embryonic development. This phenomenon can result from either of two mechanisms: (1) a shorter incubation period at higher temperatures, which offsets the expected increase in metabolic rate, or (2) a compensatory decrease in the rate at which embryos expend energy for maintenance. To distinguish the relative importance of these two mechanisms, we quantified the acute and chronic effects of temperature on embryonic metabolism in the eastern fence lizard (*Sceloporus undulatus*). First, we measured metabolic rates of individual embryos at 27 degrees, 31 degrees, and 34 degrees C. Second, we examined the capacity for thermal acclimation by measuring the metabolic rates of embryos at 30 degrees C, after a period of incubation at either 28 degrees or 32 degrees C. As with adult reptiles, the metabolic rates of embryos increased with an acute increase in temperature; the Q(10) of metabolic rate from 27 degrees to 34 degrees C was 2.1 (+/-0.2). No evidence of thermal acclimation was observed either early or late in development. In *S. undulatus*, a shorter incubation period at higher temperatures appears to play the primary role in canalizing the energy budget of an embryo, but a reduction in the cost of growth could play a secondary role.
Descriptors: lizards, acclimatization physiology, embryonic development physiology, lizards embryology, lizards physiology, basal metabolism physiology, embryo, non-mammalian physiology, oviparity physiology, temperature.

Birkedal, R. and H. Gesser (2004). **Effects of hibernation on mitochondrial regulation and metabolic capacities in myocardium of painted turtle (*Chrysemys picta*).** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 139(3): 285-291. ISSN: 1095-6433.

Abstract: Painted turtles hibernating during winter may endure long-term exposure to low temperature and anoxia. These two conditions may affect the aerobic capacity of a tissue and might be of particular importance to the cardiac muscle normally highly reliant on aerobic energy production. The present study addressed how hibernation affects respiratory characteristics of mitochondria in situ and the metabolic pattern of turtle myocardium. Painted turtles were acclimated to control (25 degrees C), cold (5 degrees C) normoxic and cold anoxic conditions. In saponin-skinned myocardial fibres, cold acclimation increased mitochondrial respiratory capacity and decreased apparent ADP-affinity. Concomitant anoxia did not affect this. Creatine increased the apparent ADP-affinity to similar values in the three acclimation groups, suggesting a functional coupling of creatine kinase to mitochondrial respiration. As to the metabolic pattern, cold acclimation decreased glycolytic capacity in terms of pyruvate kinase activity and increased lactate dehydrogenase (LHD) activity. Concomitant anoxia counteracted the cold-induced decrease in pyruvate kinase activity and increased creatine kinase activity. In conclusion, cold acclimation seems to increase aerobic and decrease anaerobic energy production capacity in painted turtle myocardium. Importantly, anoxia does not affect the mitochondrial functional integrity but seems to increase the capacity for anaerobic energy production and energy buffering.

Descriptors: reptiles, painted turtle, hibernation, effects, metabolic capacities, myocardium, mitochondrial regulation, anoxia, low temperature.

Bouchard, S.S. and K.A. Bjorndal (2006). **Ontogenetic diet shifts and digestive constraints in the omnivorous freshwater turtle *Trachemys scripta*.** *Physiological and Biochemical Zoology* 79(1): 150-158. ISSN: 1522-2152.

NAL Call Number: QL1.P52

Abstract: Many reptiles undergo an ontogenetic diet shift from carnivory to herbivory. In this study, we used the yellow-bellied slider turtle, *Trachemys scripta*, as a model to evaluate whether juvenile turtles are carnivorous because physiological constraints preclude herbivory. We conducted feeding trials in which we fed juvenile and adult turtles a duckweed plant, *Lemna valdiviana*, or a freshwater grass shrimp, *Palaemontes paludosus*, for 5 wk. During the trials, we measured mass-specific intake, digestibility, and digestible intake for both size classes, as well as juvenile growth. At the end of the trials, we measured the nutrient composition of the juvenile turtles. Juveniles fed shrimp grew 3.2 times faster than those fed duckweed and had equivalent lipid stores. Digestive processing in juveniles was extremely efficient on the shrimp diet, with higher mass-specific intakes than adults and very high digestibilities (97%). Juveniles digested duckweed as well as adults did; however, their intake of this diet was limited, possibly by the time required for fermentation. We concluded that although juveniles can process plant material, an animal diet allows for greater juvenile growth, which in turtles is linked to higher survivorship and increased future reproductive success.

Descriptors: juvenile slider turtles, diet, digestion physiology, feeding behavior physiology, turtles growth, development, physiology, gastrointestinal contents.

Bouchard, S.S. and K.A. Bjorndal (2006). **Nonadditive interactions between animal and plant diet items in an omnivorous freshwater turtle *Trachemys scripta*.** *Comparative Biochemistry and Physiology. Part B, Biochemistry and Molecular Biology* 144(1): 77-85. ISSN: 1096-4959.

Abstract: Nonadditive interactions occur when diet items interact with one another such that the net energy or nutrient gain from a mixed diet differs from that predicted by summing the gains from individual diet components. We quantified nonadditive effects between duckweed, *Lemma valdiviana*, and grass shrimp, *Palaemontes paludosus*, in the freshwater turtle *Trachemys scripta*. We fed turtles 100% duckweed, 100% shrimp, and two mixed diets containing 67% duckweed, 33% shrimp and 14% duckweed, 86% shrimp (dry matter basis). During each feeding trial, we measured intake, digestibility, and transit time of the diet, and upon conclusion, short-chain fatty acid concentrations in turtle digestive tracts. Digestibility was lower on the 67% duckweed diet, but higher on the 14% diet. These apparent nonadditive interactions may be due to differences in transit time of duckweed and shrimp. We believe this is the first evidence of two diet items producing opposing nonadditive effects when fed in different ratios.

Descriptors: freshwater turtle *Trachemys scripta*, diet, digestion physiology, feeding behavior, gastrointestinal transit, duckweed and grass shrimp physiology, Palaemonidae, plants, turtles physiology, eating gastrointestinal contents, nutritive value.

Bradshaw, C.J., C.R. McMahon, and G.C. Hays (2007). **Behavioral inference of diving metabolic rate in free-ranging leatherback turtles.** *Physiological and Biochemical Zoology* 80(2): 209-219. ISSN: 1522-2152.

NAL Call Number: QL1.P52

Abstract: Good estimates of metabolic rate in free-ranging animals are essential for understanding behavior, distribution, and abundance. For the critically endangered leatherback turtle (*Dermochelys coriacea*), one of the world's largest reptiles, there has been a long-standing debate over whether this species demonstrates any metabolic endothermy. In short, do leatherbacks have a purely ectothermic reptilian metabolic rate or one that is elevated as a result of regional endothermy? Recent measurements have provided the first estimates of field metabolic rate (FMR) in leatherback turtles using doubly labeled water; however, the technique is prohibitively expensive and logistically difficult and produces estimates that are highly variable across individuals in this species. We therefore examined dive duration and depth data collected for nine free-swimming leatherback turtles over long periods (up to 431 d) to infer aerobic dive limits (ADLs) based on the asymptotic increase in maximum dive duration with depth. From this index of ADL and the known mass-specific oxygen storage capacity (To(2)) of leatherbacks, we inferred diving metabolic rate (DMR) as To2/ADL. We predicted that if leatherbacks conform to the purely ectothermic reptilian model of oxygen consumption, these inferred estimates of DMR should fall between predicted and measured values of reptilian resting and field metabolic rates, as well as being substantially lower than the FMR predicted for an endotherm of equivalent mass. Indeed, our behaviorally derived DMR estimates (mean=0.73+/-0.11 mL O(2) min(-1) kg(-1)) were 3.00+/-0.54 times the

resting metabolic rate measured in unrestrained leatherbacks and 0.50+/-0.08 times the average FMR for a reptile of equivalent mass. These DMRs were also nearly one order of magnitude lower than the FMR predicted for an endotherm of equivalent mass. Thus, our findings lend support to the notion that diving leatherback turtles are indeed ectothermic and do not demonstrate elevated metabolic rates that might be expected due to regional endothermy. Their capacity to have a warm body core even in cold water therefore seems to derive from their large size, heat exchangers, thermal inertia, and insulating fat layers and not from an elevated metabolic rate.

Descriptors: reptiles, leatherback turtles, diving metabolic rate, behavioral inference, metabolic rate, ectothermic, warm body core.

Britt, E.J., J.W. Hicks, and A.F. Bennett (2006). **The energetic consequences of dietary specialization in populations of the garter snake, *Thamnophis elegans*.** *Journal of Experimental Biology* 209(Pt 16): 3164-3169. ISSN: 0022-0949.

Online: http://dx.doi.org/10.1242/jeb.02366

NAL Call Number: 442.8 B77

Abstract: We investigated the intraspecific variation in digestive energetics between dietary specialist and generalist populations of the Western Terrestrial garter snake (*Thamnophis elegans*) in northern California. Coastal populations have a specialized diet of slugs and inland populations have a generalized diet of fish, anurans, mice and leeches. The difference in prey preference between the two populations is congenital, heritable and ontogenetically stable. To examine energetic specializations and trade-offs in these populations, we measured the net assimilation efficiency of each snake population on both slug (*Ariolimax columbianus*) and fish (*Rhinichthys osculus*) diets. The net assimilation efficiency was measured during digestion of a meal and continued until metabolic rate re-attained prefeeding levels. Coastal snakes were able to utilize 62% more of the ingested energy towards production from slug diets through both increased assimilation of nutrients and reduced digestive costs. For fish, assimilation and digestive costs were the same in both coastal and inland populations. These results support the hypothesis that snakes with specialized diets can evolve physiological traits to extract nutrients more efficiently. However, there was no apparent trade-off on the more generalized diet that was associated with this specialization.

Descriptors: Colubridae metabolism, diet, adaptation, physiological, Colubridae genetics, Colubridae physiology, cyprinidae, digestion physiology, energy metabolism, food preferences, gastropoda, nutritive value.

Chen, H.l., M.b. Ye, and R.j. Lin (2006). **High density feeding of green turtle through hibernation.** *Sichuan Journal of Zoology* 25(2): 395-397. ISSN: 1000-7083.

Descriptors: reptiles, *Chelonia mydas*, green turtle, rearing techniques, high density feeding, through hibernation, winter.

Language of Text: Chinese; Summary in Chinese and English.

Clark, T.D., P.J. Butler, and P.B. Frappell (2005). **Digestive state influences the heart rate hysteresis and rates of heat exchange in the varanid lizard *Varanus rosenbergi*.** *Journal of Experimental Biology* 208(Pt 12): 2269-2276. ISSN: 0022-0949.

Online: http://dx.doi.org/10.1242/jeb.01657
NAL Call Number: 442.8 B77
Abstract: To maximize the period where body temperature (Tb) exceeds ambient temperature (Ta), many reptiles have been reported to regulate heart rate (fH) and peripheral blood flow so that the rate of heat gain in a warming environment occurs more rapidly than the rate of heat loss in a cooling environment. It may be hypothesized that the rate of cooling, particularly at relatively cool Tbs, would be further reduced during postprandial periods when specific dynamic action (SDA) increases endogenous heat production (i.e. the heat increment of feeding). Furthermore, it may also be hypothesized that the increased perfusion of the gastrointestinal organs that occurs during digestion may limit peripheral blood flow and thus compromise the rate of heating. Finally, if the changes in fh are solely for the purpose of thermoregulation, there should be no associated changes in energy demand and, consequently, no hysteresis in the rate of oxygen consumption (V(O2)). To test these hypotheses, seven individual *Varanus rosenbergi* were heated and cooled between 19 degrees C and 35 degrees C following at least 8 days fasting and then approximately 25 h after consumption of a meal (mean 10% of fasted body mass). For a given Tb between the range of 19-35 degrees C, fh of fasting lizards was higher during heating than during cooling. Postprandial lizards also displayed a hysteresis in fh, although the magnitude was reduced in comparison with that of fasting lizards as a result of a higher fh during cooling in postprandial animals. Both for fasting and postprandial lizards, there was no hysteresis in V(O2) at any Tb throughout the range although, as a result of SDA, postprandial animals displayed a significantly higher V(O2) than fasting animals both during heating and during cooling at Tbs above 24 degrees C. The values of fh during heating at a given Tb were the same for fasting and postprandial animals, which, in combination with a slower rate of heating in postprandial animals, suggests that a prioritization of blood flow to the gastrointestinal organs during digestion is occurring at the expense of higher rates of heating. Additionally, postprandial lizards took longer to cool at Tbs below 23 degrees C, suggesting that the endogenous heat produced during digestion temporarily enhances thermoregulatory ability at lower temperatures, which would presumably assist *V. rosenbergi* during cooler periods in the natural environment by augmenting temperature-dependent physiological processes.
Descriptors: lizard, *Varanus rosenbergi*, body temperature regulation, digestive system, gastrointestinal tract, blood supply, heart rate, postprandial period, body temperature , electrocardiography, oxygen consumption.

Clusella Trullas, S., J.R. Spotila, and F.V. Paladino (2006). **Energetics during hatchling dispersal of the olive ridley turtle *Lepidochelys olivacea* using doubly labeled water.** *Physiological and Biochemical Zoology* 79(2): 389-399. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Studies of metabolism are central to the understanding of the ecology, behavior, and evolution of reptiles. This study focuses on one phase of the sea turtle life cycle, hatchling dispersal, and gives insight into energetic constraints that dispersal imposes on hatchlings. Hatchling dispersal is an energetically expensive phase in the life cycle of the olive ridley turtle *Lepidochelys olivacea*. Field metabolic rates (FMRs), determined using the doubly labeled water (DLW) method, for L. olivacea hatchlings digging out of their nest chamber,

crawling at the sand surface, and swimming were five, four, and seven times, respectively, the resting metabolic rate (RMR). The cost of swimming was 1.5 and 1.8 times the cost of the digging and crawling phases, respectively, and we estimated that if *L. olivacea* hatchlings swim at frenzy levels, they can rely on yolk reserves to supply energy for only 3-6 d once they reach the ocean. We compared our RMR and FMR values by establishing an interspecific RMR mass-scaling relationship for a wide range of species in the order Testudines and found a scaling exponent of 1.06. This study demonstrates the feasibility of using the DLW method to estimate energetic costs of free-living sea turtle hatchlings and emphasizes the need for metabolic studies in various life-history stages.
Descriptors: olive ridley turtle *Lepidochelys olivacea*, newborn metabolism, energy metabolism physiology, turtles metabolism, water metabolism, body weight, deuterium, motor activity physiology, oxygen isotopes, species specificity.

Craig, M.D., P.C. Withers, and S.D. Bradshaw (2006). **Patterns of diet and microhabitat use by four species of sympatric *Ctenotus* lizards: Do they reveal foraging specialisation?** *Journal of the Royal Society of Western Australia* 89(1): 1-5. ISSN: 0035-922X.
NAL Call Number: 514 P432
Descriptors: reptiles, *Ctenotus* lizards, diet, microhabitat, patterns, foraging specialisation, foraging.

Donovan, E.R. and T.T. Gleeson (2006). **Metabolic support of moderate activity differs from patterns seen after extreme behavior in the desert iguana *Dipsosaurus dorsalis*.** *Physiological and Biochemical Zoology* 79(2): 370-388. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: This study examined glucose and lactate metabolism in an iguanid lizard, *Dipsosaurus dorsalis*, during rest and after activity patterned on field behavior (15 s of running at 1 m/s). Metabolite oxidation and incorporation into glycogen by the whole animal, the liver, and oxidative and glycolytic muscle fibers were measured using (14)C- and (13)C-labeled compounds. Results showed that lactate metabolism is more responsive to changes that occurred between rest and recovery, whereas glucose appears to play a more steady state role. After activity, lactate oxidation produced 57 times as much ATP during 1 h of recovery than did glucose oxidation. However, lactate oxidation rates were elevated for only 30 min after activity, while glucose oxidation remained elevated beyond 1 h. Lactate was the primary source for glycogen synthesis during recovery, and glucose was the main glycogenic substrate during rest. This study supports previous research showing that brief activity in *D. dorsalis* is primarily supported by glycolysis and phosphocreatine breakdown, but it also suggests that there may be less of a reliance on glycolysis and a greater reliance on phosphocreatine than previously shown. The findings presented here indicate that the metabolic consequences of the behaviorally relevant activity studied are less severe than has been suggested by studies using more extreme activity patterns.
Descriptors: desert iguana, *Dipsosaurus dorsalis*, behavior, physiology, desert climate, iguanas metabolism, adenosine triphosphate metabolism, glucose metabolism, glycogen blood, metabolism, lactic acid blood, metabolism, liver metabolism, motor activity, skeletal metabolism.

Elsey, R.M. (2006). **Food habits of *Macrochelys temminckii* (alligator snapping turtle) from Arkansas and Louisiana**. *Southeastern Naturalist* 5(3): 443-452. ISSN: 1528-7092.
NAL Call Number: 409.6 So8
Descriptors: reptiles, alligator snapping turtle, *Macrochelys temminckii*, food habits, stomach contents, intestinal contents, fish, crawfish, molluscs, turtles, variety.

Ferreira, B., M. Garcia, B.P. Jupp, and A. Al Kiyumi (2006). **Diet of the green turtle (*Chelonia mydas*) at Ra's Al Hadd, Sultanate of Oman.** *Chelonian Conservation and Biology* 5(1): 141-146. ISSN: 1071-8443.
Descriptors: reptiles, green turtle, *Chelonia mydas*, plants, diet, Oman.

Finke, M.D. (2003). **Gut loading to enhance the nutrient content of insects as food for reptiles: a mathematical approach.** *Zoo Biology* 22(2): 147-162. ISSN: 0733-3188.
NAL Call Number: QL77.5.Z6
Descriptors: reptiles, zoo animals, animal feeding, *Acheta domesticus*, *Tenebrio molitor*, *Bombyx mori*, gut loading, insects, nutrient content, insects as food, nutritive value.

Fledelius, B. and B. Bruun (2004). **Vitaminers og mineralers betydning for vores krybdyr. [The importance of vitamins and minerals for the reptiles we keep.]**. *Nordisk Herpetologisk Forening* 47(5): 150-158. ISSN: 0900-484X.
Descriptors: reptiles, vitamins, minerals, importance, captive.
Language of Text: Danish; Summary in Danish and English.

Fodor, K., A. Beregi, V. Molnar, F. Felkai, and S. Fekete (2004). **A hullok takarmanyozasanak alapelvei, takarmanyozasi eredetu betegsegek. 2. Takarmanyozasi eredetu betegsegek. [Basic knowledge of reptiles' feeding and nutritional disorders. 2. Nutritional disorders in reptiles].** *Magyar Allatorvosok Lapja* 126(7): 424-432. ISSN: 0025-004X.
Descriptors: reptiles, nutritional disorders, feeding, basic knowledge of reptile nutrition, diet.
Language of Text: Hungarian; Summary in English.

Fodor, K., A. Beregi, V. Molnar, F. Felkai, and S. Fekete (2004). **A hullok takarmanyozasanak alapelvei, takarmanyozasi eredetu betegsegek. 1. Altalanos takarmanyozastani ismeretek. [Basic knowledge of reptiles' feeding and nutritional disorders. 1. Basic knowledge of nutrition].** *Magyar Allatorvosok Lapja* 126(5): 281-289. ISSN: 0025-004X.
Descriptors: reptiles, feeding, nutritional disorders, basic knowledge, diet, nutrition.
Language of Text: Hungarian; Summary in English.

Forero Medina, G. and O. Castano Mora (2006). ***Kinosternon scorpioides albogulare* (white-throated mud turtle). Feeding behavior and diet.** *Herpetological Review* 37(4): 458-459. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: white-throated mud turtle, *Kinosternon scorpioides albogulare*, reptiles, feeding behavior, diet.

Gal, J. (2003). **Meszsolerakodas vitorlas agama (*Hydrosaurus amboinensis*) verereiben. [Calcification in blood vessels of a sailfin lizard (*Hydrosaurus amboinensis*)].** *Magyar Allatorvosok Lapja* 125(11): 687-689. ISSN: 0025-004X.
Descriptors: reptiles, lizard, blood vessels, calcification, nutrition.
Language of Text: Hungarian; Summary in English.

Hare, K.M., S. Pledger, M.B. Thompson, J.H. Miller, and C.H. Daugherty (2006). **Daily patterns of metabolic rate among New Zealand lizards (Reptilia: Lacertilia: Diplodactylidae and Scincidae).** *Physiological and Biochemical Zoology* 79(4): 745-753. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: In addition to the effects of temperature fluctuations on metabolic rate, entrained endogenous rhythms in metabolism, which are independent of temperature fluctuations, may be important in overall energy metabolism in ectotherms. Daily entrained endogenous rhythms may serve as energy-conserving mechanisms during an animal's active or inactive phase. However, because nocturnal lizards often take advantage of thermal opportunities during the photophase (light), their daily metabolic rhythms may be less pronounced than those of diurnal species. We measured the rate of oxygen consumption (VO(2)) as an index of metabolic rate of eight temperate lizard species (four nocturnal, three diurnal, and one crepuscular/diurnal; n = 7-14) over 24 h at 13 degrees C and in constant darkness to test whether daily patterns (including amplitude, magnitude, and time of peak VO(2)) of metabolic rate in lizards differ with activity period. We also tested for phylogenetic differences in metabolic rate between skinks and geckos. Three daily patterns were evident: 24-h cycle, 12-h cycle, or no daily cycle. The skink *Cyclodina aenea* has a 12-h crepuscular pattern of oxygen consumption. In four other species, VO(2) increased with, or in anticipation of, the active part of the day, but three species had rhythms offset from their active phase. Although not correlated with activity period or phylogeny, amplitude of VO(2) may be correlated with whether a species is temperate or tropical. In conclusion, the metabolic rate of many species does not always correlate with the recorded activity period. The dichotomy of ecology and physiology may be clarified by more in-depth studies of species behaviors and activity periods.
Descriptors: lizards, circadian rhythm physiology, energy metabolism physiology, lizards physiology, New Zealand.

Hibma, J.C. (2004). **Dietary vitamin D3 and UV-B exposure effects on green iguana growth rate: is full-spectrum lighting necessary?** *Bulletin of the Chicago Herpetological Society* 39(8): 145-150. ISSN: 0009-3564.
Descriptors: reptiles, green iguana, dietary vitamin D3, UV-B exposure effects, full spectrum lighting, necessary, growth rate.

Hicks, J.W. and T. Wang (2004). **Hypometabolism in reptiles: behavioural and physiological mechanisms that reduce aerobic demands.** *Respiratory Physiology and Neurobiology* 141(3): 261-271. ISSN: 1569-9048.
NAL Call Number: QP121.A1 R4
Abstract: During exposure to hypoxia all vertebrates utilize a suite of cardiovascular and

ventilatory responses that, in combination, strive to maintain adequate delivery of oxygen to the metabolizing tissues. In addition to maintaining oxygen delivery through cardio-respiratory responses, oxygen demands in the tissues can also be reduced. Reptiles use this alternative strategy during periods of moderate to severe hypoxia by behavioural reductions in preferred body temperature and by active down-regulation of aerobic metabolism. Below we review these two different strategies and discuss their possible mechanisms and physiological significance.

Descriptors: reptiles, hypometabolism, aerobic demands, hypoxia, cardiovascular response, ventilatory, oxygen delivery, metabolism.

Hopkins, W.A., J.H. Roe, T. Philippi, and J.D. Congdon (2004). **Standard and digestive metabolism in the banded water snake, *Nerodia fasciata fasciata*.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 137(1): 141-149. ISSN: 1095-6433.

Abstract: Estimating energy costs by respirometry is fundamental to many studies of the ecology, behavior and evolution of reptiles. However, traditional respirometry procedures seldom incorporate objective techniques for removal of outliers from estimates of metabolic parameters. We demonstrate how computer-automated respirometry equipment, which records many respiratory measurements over short intervals, can be coupled with mathematical procedures to produce robust estimates of pre- and post-prandial metabolism in banded water snakes (*Nerodia fasciata fasciata*). Standard metabolic rate of *N. f. fasciata* was estimated to be 1.21 ml O2/h (mass = 30.21 +/- 0.74 g) at 25 degrees C. After ingestion of a fish equaling 20% of their body mass, snakes exhibited a fivefold increase in metabolic rate with peak O2 consumption rate (VO2) reaching 6.5 ml O2/h. Total cost of digestion was 5.44 kJ, equivalent to approximately 21% of the energy in the meal. Repeated measurements of metabolism in the same individuals revealed that our methods yielded similar results, even when individuals exhibited different patterns of VO2 variation between respiratory trials. Our results underscore the importance of obtaining many VO2 measurements, coupled with objective removal of outlier values from estimates of metabolic rate, especially when metabolic values are to be interpreted in a comparative context.

Descriptors: water snake, *Nerodia fasciata fasciata*, metabolism, digestive, standard, energy costs, computer automated, respirometry equipment, VO2 measurements.

Huang, C.H. and W.Y. Lin (2002). **Estimation of optimal dietary methionine requirement for softshell turtle, *Pelodiscus sinensis*.** *Aquaculture* 207(3-4): 281-287. ISSN: 0044-8486.

Abstract: A growth experiment was conducted to determine the optimal level of dietary methionine for softshell turtle, *Pelodiscus sinensis*. Five experimental diets analyzed to contain 0.67% to 1.24% of methionine were fed to juvenile softshell turtle with 3.2 g initial body weight for 8 weeks. The dietary protein and estimated metabolizable energy contents were 41.5% and 3.34 kcal/g, respectively. Weight gain (WG) of the turtle fed the diet containing 0.67% methionine was significantly lower than those fed diets containing 0.81% and 1.07% methionine ($P<0.05$). Feed conversion ratio (FCR) and protein efficiency ratio (PER) showed similar trends to that of WG. No significant difference ($P>0.05$) was found in body composition among turtles fed the different diets. Using a second-order polynomial regression analysis of WG and FCR on level of dietary methionine, the optimal dietary methionine

content was 1.03% of diet or 2.48% of dietary protein when cystine content was 0.25% of diet or 0.60% of dietary protein.

Descriptors: reptiles, softshell turtle, *Pelodiscus sinensis*, optimal dietary methonine, estimation, growth experiment, diets, dietary protein.

Huang, C.H. and W.Y. Lin (2004). **Effects of dietary vitamin E level on growth and tissue lipid peroxidation of soft-shelled turtle, *Pelodiscus sinensis* (Wiegmann).** *Aquaculture Research* 35(10): 948-954. ISSN: 1355-557X.

NAL Call Number: SH1.F8

Abstract: A feeding trial was conducted to determine the effect of dietary vitamin E supplementation on growth, liver lipid peroxidation and liver and muscle vitamin E level of soft-shelled turtle, *Pelodiscus sinensis*. Eight experimental diets analysed to contain 0-457 IU vitamin E kg-1 were fed to juvenile soft-shelled turtle of 4.8 g initial body weight for 12 weeks. Weight gain (WG) of the turtles fed the diet containing no vitamin E was significantly lower than those fed diets containing 83-457 IU vitamin E kg-1 ($P<0.05$). Feed conversion ratio and protein efficiency ratio showed similar trends to that of WG. No significant difference ($P>0.05$) was found in whole-body composition among turtles fed the different diets. Dietary vitamin E requirement using WG as the response and estimated using the broken-line regression model is approximately 88 IU kg-1. Liver and muscle vitamin E content increased when dietary vitamin E level increased. Ascorbate-induced lipid peroxidation in liver tissue of turtles fed diets containing 0 and 17 IU vitamin E kg-1 was significantly ($P<0.05$) greater than those fed diets containing high vitamin E (> = 35 IU kg-1).

Descriptors: reptiles, soft shelled turtle, *Pelodiscus sinensis*, dietary vitamin E, effects, frowth, tissue lipid peroxidation, feeding trial.

Huang, C.H., W.Y. Lin, and S.M. Wu (2003). **Effect of dietary calcium and phosphorus supplementation in fish meal-based diets on the growth of soft-shelled turtle *Pelodiscus sinensis* (Wiegmann).** *Aquaculture Research* 34(10): 843-848. ISSN: 1355-557X.

NAL Call Number: SH1.F8

Abstract: A growth experiment was conducted to determine the effect of supplementing dietary calcium in fish meal-based diets on the growth of cultured soft-shelled turtle *Pelodiscus sinensis*. Juvenile soft-shelled turtles of 4.1 g mean body weight were fed nine diets containing two levels of phosphorus (2.7% or 3.0%) and analysed calcium levels ranging from 4.7% to 6.6% for 10 weeks. The growth of the turtles was enhanced when inorganic calcium was added to the diets. The weight gain of the turtles fed the control diet containing calcium solely from fish meal was the lowest among the test groups, and was significantly lower than those fed the diet containing 5.7% calcium at the 3.0% phosphorus level ($P<0.05$). Feed conversion and protein efficiency ratios were not affected by different dietary treatments. Whole-body moisture and crude protein contents of turtles were not affected by different dietary treatments. The body ash of turtles fed 3.0% phosphorus diets tended to be higher than turtles fed 2.7% phosphorus diets. The body calcium to phosphorus ratio of turtles fed 3.0% phosphorus diets was greater than that of turtles fed diets containing 2.7% phosphorus. Supplementation of Ca in a fish meal-based practical diet is required for the

optimum growth of soft-shelled turtles.
Descriptors: reptiles, soft shelled turtle, *Pelodiscus sinensis*, dietary calcium, phosphorus, fish meal based diets, growth, effect, supplementary calcium, optimum growth.

Huang, C.H., W.Y. Lin, and J.H. Chu (2005). **Dietary lipid level influences fatty acid profiles, tissue composition, and lipid peroxidation of soft-shelled turtle, *Pelodiscus sinensis*.** *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 142(3): 383-388. ISSN: 1095-6433.
Descriptors: reptiles, softshelled turtle, *Pelodiscus sinensis*, lipid level, fatty acid profiles, tissue composition, lipid peroxidation, diet, lipid level.

Kik, M.J. and A.C. Beynen (2003). **Beoordeling van een aantal commerciele voeders voor leguanen (*Iguana iguana*), baardagamen (*Pogona vitticeps*) en land- en moerasschildpadden. [Evaluation of a number of commercial diets for iguana (*Iguana iguana*), bearded dragons (*Pogona vitticeps*), and land and marsh tortoises]**. *Tijdschrift Voor Diergeneeskunde* 128(18): 550-554. ISSN: 0040-7453.
Abstract: Fifteen commercially available, complete diets for iguanas, bearded dragons, and chelonians were analysed and compared with the ideal composition of a diet formulated by the authors. The clinical risks of feeding with a too high or a too low content of specific nutrients are described. Nutrient deficiencies are not expected if these diets are the sole source of nutrients. However, one diet had only a marginally adequate protein content, five diets for herbivorous reptiles contained a too low percentage of crude fibre, three diets contained an undesirably high percentage of calcium, and three diets had an extremely high iron content. As a rule, the calcium and iron contents of diets are not declared on the food label, which complicates evaluation of the diets.
Descriptors: reptiles, iguana, bearded dragons, commercial diets, evaluation, land and marsh tortoises, nutrients, feeding, nutrient deficiencies, crude fibre, calcium.
Language of Text: Dutch.

Kik, M.J.L., G.M. Dorrestein, and A.C. Beynen (2003). **Evaluation of 15 commercial diets and their possible relation to metabolic diseases in different species of reptiles**. In: *Erkrankungen der Zootiere: Verhandlungsbericht des 41 Internationalen Symposiums uber die Erkrankungen der Zoo und Wildtiere. [Proceedings of the Institute for Zoo and Wildlife Research, Berlin, No.5],May 28, 2003-June 1, 2003, Rome, Italy,* p. 87-90.
Descriptors: reptiles, commercial diets, metabolic diseases, possible relation between nutrition and disease.

Klarsfeld, J.D. and M.A. Mitchell (2005). **An evaluation of the gray cricket, *Acheta domestica*, as a source of oxyurids for reptiles.** *Journal of Herpetological Medicine and Surgery* 15(1): 18-20. ISSN: 1529-9651.
NAL Call Number: SF997.5.R4 B85
Descriptors: reptiles, Acheta domestica, gray cricket, diet, source of oxyurids, evaluation.

Koelle, P. and E. Kienzle (2006). **Diets for tube feeding or force feeding in reptile medicine.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 13: 23-25. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: reptiles, diet, captivity, tube feeding, force feeding, sick individuals, reptile medicine.

Ladyman, M., X. Bonnet, O. Lourdais, D. Bradshaw, and G. Naulleau (2003). **Gestation, thermoregulation, and metabolism in a viviparous snake, *Vipera aspis*: evidence for fecundity-independent costs.** *Physiological and Biochemical Zoology* 76(4): 497-510. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Oxygen consumption of gestating Aspic vipers, *Vipera aspis* (L.), was strongly dependent on body temperature and mass. Temperature-controlled, mass-independent oxygen consumption did not differ between pregnant and nonpregnant females. Maternal metabolism was not influenced during early gestation by the number of embryos carried but was weakly influenced during late gestation. These results differ from previous investigations that show an increase in mass-independent oxygen consumption in reproductive females relative to nonreproductive females and a positive relationship between metabolism and litter size. These data also conflict with published field data on *V. aspis* that show a strong metabolic cost associated with reproduction. We propose that, under controlled conditions (i.e., females exposed to precise ambient temperatures), following the mobilisation of resources to create follicles (i.e., vitellogenesis), early gestation per se may not be an energetically expensive period in reproduction. However, under natural conditions, the metabolic rate of reproductive females is strongly increased by a shift in thermal ecology (higher body temperature and longer basking periods), enabling pregnant females to accelerate the process of gestation. Combining both laboratory and field investigation in a viviparous snake, we suggest that reproduction entails discrete changes in the thermal ecology of females to provide optimal temperatures to the embryos, whatever their number. This results in the counterintuitive notion that metabolism may well be largely independent of fecundity during gestation, at least in an ectothermic reptile.
Descriptors: reptiles, viviparous snake, *Vipera aspis*, gestation, thermoregulation, metabolism, fecundity, body temperature, oxygen consumption.

Lei, S.J. (2006). **Effects of ration level and feeding frequency on digestibility in juvenile soft-shelled turtle, *Pelodiscus sinensis*.** *Journal of Zhejiang University. Science. B* 7(7): 580-585. ISSN: print: 1673-1581; online: 1862-1783.
Abstract: The effects of ration level and feeding frequency on digestibility in juvenile soft-shelled turtle, *Pelodiscus sinensis*, were investigated. Four ration levels 1.5%, 2.5%, 4.0% and satiation (6.0% BW/d) were used. Apparent digestibility (AD) of dry matter (DMAD), protein (PAD) and protein real digestibility (PRD) were significantly affected by ration level, but not by feeding frequency when the ration level was similar. However, the feeding frequency affected the AD, DMAD, PAD and PRD significantly when the turtles were fed to satiation. The relationship between fecal protein content (Y) and protein intake (X) can

be expressed as a quadric equation: Y=-0.1742+0.1476X-0.0003X(2) (r(2)=0.876, n=27, F=93.92, P<0.01).
Descriptors: juvenile soft-shelled turtle, *Pelodiscus sinensis*, turtle feed analysis, feed classification, digestion physiology, feeding behavior physiology, food deprivation physiology, turtles physiology, food analysis, periodicity.

Lei, S.j. and S.z. Ye (2004). **Effect of ration level on growth in juvenile soft-shelled turtles, *Trionyx sinensis*.** *Zoological Research* 25(1): 43-47. ISSN: 0254-5853.
Online: http://www.bioline.org.br/abstract?id=zr04008&lang=en
NAL Call Number: QL1.T85
Descriptors: reptiles, soft shelled turtles, *Trionyx sinensis*, ration level, growth, effect, juvenile, diet, food intake.
Language of Text: Chinese; Summary in Chinese and English.

Li, M., B.G. Fry, and R.M. Kini (2005). **Eggs-only diet: its implications for the toxin profile changes and ecology of the marbled sea snake (*Aipysurus eydouxii*).** *Journal of Molecular Evolution* 60(1): 81-89. ISSN: print: 0022-2844; online: 1432-1432.
NAL Call Number: QH359.J6
Abstract: Studies so far have correlated the variation in the composition of snake venoms with the target prey population and snake's diet. Here we present the first example of an alternative evolutionary link between venom composition and dietary adaptation of snakes. We describe a dinucleotide deletion in the only three finger toxin gene expressed in the sea snake *Aipysurus eydouxii* (Marbled Sea Snake) venom and how it may have been the result of a significant change in dietary habits. The deletion leads to a frame shift and truncation with an accompanying loss of neurotoxicity. Due to the remarkable streamlining of sea snake venoms, a mutation of a single toxin can have dramatic effects on the whole venom, in this case likely explaining the 50- to 100-fold decrease in venom toxicity in comparison to that of other species in the same genus. This is a secondary result of the adaptation of A. eydouxii to a new dietary habit--feeding exclusively on fish eggs and, thus, the snake no longer using its venom for prey capture. This was parallel to greatly atrophied venom glands and loss of effective fangs. It is interesting to note that a potent venom was not maintained for use in defense, thus reinforcing that the primary use of snake venom is for prey capture.
Descriptors: marbled sea snake, *Aipysurus eydouxii*, diet, eggs only diet, toxin profile changes, venom, prey capture, dietary adaptation, loss of neurotoxicity.

Litzgus, J.D. and W.A. Hopkins (2003). **Effect of temperature on metabolic rate of the mud turtle (*Kinosternon subrubrum*).** *Journal of Thermal Biology* 28(8): 595-600. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: reptiles, mud turtle, *Kinosternon subrubrum*, temperature, metabolic rate, effect, oxygen consumption, ectotherms.

Luiselli, L. (2006). **Broad geographic, taxonomic and ecological patterns of interpopulation variation in the dietary habits of snakes.** *Web Ecology* 6: 2-16. ISSN: 1399-1183.
Descriptors: reptiles, snakes, diets, variation, habits, taxonomic, ecological, patterns, diet composition, carnivorous.

Luiselli, L., G.C. Akani, F.M. Angelici, E. Politano, L. Ude, and S.M. Wariboko (2003). **Diet of the semi-aquatic snake, *Afronatrix anoscopus* (colubridae) in southern Nigeria.** *African Journal of Herpetology* 52(2): 123-126. ISSN: 0441-6651.
Descriptors: reptiles, snake, *Afronatrix anoscopus*, diet, semi-aquatic, stomach contents, Nigeria.

Maxwell, L.K., E.R. Jacobson, and B.K. McNab (2003). **Intraspecific allometry of standard metabolic rate in green iguanas, *Iguana iguana*.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 136(2): 301-310. ISSN: 1095-6433.
Abstract: To study the allometric relationship between standard metabolic rate and body mass (mass range 16-3627 g) in green iguanas, *Iguana iguana* (n=32), we measured rates of oxygen consumption (V(O(2))) at 30 degrees C during scotophase. The relationship could be described as: V(O(2))(ml h(-1))=0.478W(0.734). The resulting mass exponent was similar to the 3/4 power commonly used in interspecific curves (P>0.05), but differed from a proposed intraspecific value of 2/3 (P<0.05). The mass exponents of male (n=8) and female (n=11) iguanas did not differ (P>0.05). The mass adjusted V(O(2)) was higher than predicted from generalized squamate curves. The mean mass exponent of intra-individual allometric equations of iguanas (n=7) at varying masses during ontogeny did not differ from that of the pooled equation, indicating that scaling of V(O(2)) is similar for both between and within individuals. Thermal acclimation, compensatory changes in V(O(2)) with prolonged exposure to a constant temperature, was not observed in juvenile iguanas (n=11) between 1 and 5 weeks of acclimation at 30 degrees C.
Descriptors: reptiles, green iguanas, *Iguana iguana*, metabolic rate, body mass, allometric relationship, oxygen consumption.

McConnachie, S. and G.J. Alexander (2004). **The effect of temperature on digestive and assimilation efficiency, gut passage time and appetite in an ambush foraging lizard, *Cordylus melanotus melanotus*.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 174(2): 99-105. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: In ectotherms, an increase in body temperature increases metabolic rate and may increase rates of digestive processes. We measured the thermal dependence of the apparent digestive and apparent assimilation efficiencies (ADE and AAE), gut passage time (GP) and appetite in *Cordylus melanotus melanotus*, a medium sized Crag Lizard, which is endemic to South Africa. Trials were conducted at 20, 22, 25, 30, 32 and 35 degrees C under controlled conditions. Trials lasted 14 days, during which, lizards were fed ca. 1 g mealworms per day. Glass beads were used as markers to determine GP at the beginning and end of trials. Faeces and urates were collected daily and oven dried at 50 degrees C. The energy content of egested matter was then measured using bomb calorimetry. ADE and AAE were not affected by tem-

perature for either males or females. The mean+/-SE ADE and AAE were 94.4+/-0.3% and 87.2+/-0.6%, respectively. GP was not significantly different between males and females at any temperature, but decreased significantly with increasing temperature. Appetite was significantly different between the different temperatures measured. The decrease of gut passage time with increasing temperature was expected, since the digestive and assimilation efficiencies are similar over the range of temperatures tested. Lizards are thus assimilating a similar proportion of ingested energy, but at faster rates at higher temperatures. The results indicate that the digestive physiology of this species results in maximum energy gain per meal in environments where food is scarce.
Descriptors: reptiles, Crag lizard, *Cordylus melanotus melanotus*, digestive efficiency, assimilation efficiency, gut passage time, appetite, effect of temperature.

McWilliams, D.A. (2005). **Nutrition research on calcium homeostasis. II. Freshwater turtles (with recommendations).** *International Zoo Yearbook* 39: 77-85. ISSN: 0074-9664.
Descriptors: reptiles, freshwater turtles, nutrition research, calcium homeostasis, recommendations.

McWilliams, D. (2005). **Nutrition research on calcium homeostasis. I. Lizards (with recommendations).** *International Zoo Yearbook* 39: 69-77. ISSN: 0074-9664.
Descriptors: reptiles, lizards, diet in captivity, calcium homeostasis, nutrition research, recommendations.

Meyers, J.J. and A. Herrel (2005). **Prey capture kinematics of ant-eating lizards.** *Journal of Experimental Biology.* 208(Pt 1): 113-127. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01345
NAL Call Number: 442.8 B77
Abstract: While morphological and behavioral feeding specializations are obvious in many vertebrate groups, among lizards there appear to be few dietary specialists. By comparing the prey capture kinematics and overall feeding behavior in two highly specialized ant-eating lizards (*Moloch horridus* and *Phrynosoma platyrhinos*) with those of two closely related dietary generalists (*Pogona vitticeps* and *Uma notata*), we investigate whether dietary specialization has been accompanied by changes in the function and use of the feeding system. We quantified kinematic variables from high-speed video recordings (200-250 frames s(-1)) of each species feeding on ants. Prey capture was strikingly different in *M. horridus* to that of other species, being characterized by a suite of unusual behaviors including the lack of a body lunge, faster tongue protrusion, reduced prey processing and, most notably, the ability to modulate the slow open phase of the gape cycle. In concert, these traits make a single feeding event in *M. horridus* faster than that in any other iguanian lizard studied to date. Prey capture behavior in *P. platyrhinos* is kinematically more similar to *U. notata* and *P. vitticeps* than to *M. horridus*, but the ant specialists are similar in that both lack distinct prey processing behaviors, resulting in faster overall capture and feeding events. While ant feeding in *P. vitticeps* is faster than feeding on other prey, the duration of a single feeding event is still four times longer than in either ant specialist, because of extensive prey processing. Additionally, a phylogenetic comparison of ant specialist lizards with dietary generalists revealed that ant-eating

lizards require significantly less time to capture and process prey. Thus there are not only significant behavioral modifications in these ant-eating lizards, but also multiple strategies among specialists, suggesting differing selective pressures or phylogenetic constraints in the evolution of ant eating in lizards.
Descriptors: lizards, *Moloch horridus*, *Phrynosoma platyrhinos*, feeding behavior, prey capture, kinematics, ant eating, physiology, dietary specialization, tongue protrusion, feeding speed, video recordings.

Monterrosa Salinas, M.C., M.F. Salazar Castano, and A.J. Romero (2004). **Comparacion de tres dietas para el levante de neonatos de *Caretta caretta* (Linnaeus, 1758). [Comparison of three diets for raising of loggerhead turtle *Caretta caretta* hatchlings (Linnaeus, 1758).]**. In: *III Congreso Iberoamericano Virtual de Acuicultura (CIVA2004). Ponencias. [III Virtual Iberoamerican Aquaculture Congress (CIVA2004). Proceedings.],*p. 566-595.
Online: http://www.revistaaquatic.com/civa2004
Descriptors: reptiles, loggerhead turtle, *Caretta caretta*, hatchlings, diet in captivity, comparison of three diets for raising loggerhead turtle hatchlings.
Language of Text: Spanish; Summary in English and Spanish.

Mushinsky, H.R., T.A. Stilson, and E.D. McCoy (2003). **Diet and dietary preference of the juvenile gopher tortoise (*Gopherus polyphemus*)**. *Herpetologica* 59(4): 475-483. ISSN: 0018-0831.
NAL Call Number: QL640.H4
Descriptors: reptiles, gopher tortoise, *Gopherus polyphemus*, diet, dietary preference, juvenile.

Newbold, T.A.S. and J.A. Macmahon (2003). **Prey specificity and diet selection in a variable environment: desert horned lizards (*Phrynosoma platyrhinos*) and ants.** *Ecological Society of America Annual Meeting Abstracts* 88: 250-251. ISSN: 0012-9623.
Descriptors: reptiles, desert horned lizards, *Phrynosoma platyrhinos*, prey specificity, diet selection, variable environment, ants, meeting abstracts.
Notes: Meeting Information: 88th Annual Meeting of the Ecological Society of America held jointly with the International Society for Ecological Modeling - North American Chapter, Savannah, Georgia, USA; August 3-8, 2003.

O'Grady, S.P., M. Morando, L. Avila, and M.D. Dearing (2005). **Correlating diet and digestive tract specialization: examples from the lizard family Liolaemidae.** *Zoology [Jena]* 108(3): 201-210. ISSN: 0944-2006.
NAL Call Number: QL1.Z769
Abstract: A range of digestive tract specializations were compared among dietary categories in the family Liolaemidae to test the hypothesis that herbivores require greater gut complexity to process plant matter. Additionally, the hypothesis that herbivory favors the evolution of larger body size was tested. Lastly, the association between diet and hindgut nematodes was explored. Herbivorous liolaemids were larger relative to omnivorous and insectivorous congeners and consequently had larger guts. In addition, small intestine length of herbivo-

rous liolaemids was disproportionately longer than that of congeners. Significant interaction effects between diet and body size among organ dimensions indicate that increases in organ size occur to a greater extent in herbivores than other diet categories. For species with plant matter in their guts, there was a significant positive correlation between the percentage of plant matter consumed and small intestine length. Herbivorous liolaemids examined in this study lacked the gross morphological specializations (cecum and colonic valves) found in herbivores in the families Iguanidae and Agamidae. A significantly greater percentage of herbivorous species had nematodes in their gut. Of the species with nematodes, over 95% of herbivores had nematodes only in the hindgut. Prevalence of nematodes in the hindgut of herbivores was 2 x that of omnivores and 4 x that of insectivores.

Descriptors: lizards, diet, feeding behavior, gastrointestinal tract anatomy, nematoda, body size, body weights, gastrointestinal contents, gastrointestinal tract parasitology, Argentina.

Overgaard, J. and T. Wang (2002). **Increased blood oxygen affinity during digestion in the snake *Python molurus*.** *Journal of Experimental Biology* 205(Pt 21): 3327-3334. ISSN: 0022-0949.

NAL Call Number: 442.8 B77

Abstract: Many snakes exhibit large increases in metabolic rate during digestion that place extensive demands on efficient oxygen transport. In the present study, we describe blood oxygen affinity following three weeks of fasting and 48 h after feeding in the Burmese python (*Python molurus*). We also report simultaneous measurements of arterial blood gases and haematological parameters. Arterial blood was obtained from chronically implanted catheters, and blood oxygen-dissociation curves were constructed from oxygen content measurements at known oxygen partial pressure (P(O(2))) values at 2% and 5% CO(2). Arterial pH remained constant at approximately 7.6 after feeding, but digestion was associated with an approximately 6 mmol l(-1) increase in [HCO(3)(-)], while CO(2) partial pressure (P(CO(2))) increased from 2.21+/-0.13 kPa in fasted animals to 2.89+/-0.17 kPa at 48 h after feeding. Blood oxygen affinity in vivo was predicted on the basis of pH in vivo and the blood oxygen-dissociation curves obtained in vitro. The blood oxygen affinity in vivo increased during digestion, with P(50) values decreasing from 4.58+/-0.11 kPa to 3.53+/-0.24 kPa. This increase was associated with a significant decrease in the red blood cell [NTP]/[Hb(4)] ratio (relationship between the concentrations of organic phosphates and total haemoglobin) and a significant decrease in mean cellular haemoglobin content, which is indicative of swelling of the red blood cells. Our data for blood oxygen affinity and arterial oxygen levels, together with previously published values of oxygen uptake and blood flows, allow for a quantitative evaluation of oxygen transport during digestion. This analysis shows that a large part of the increased metabolism during digestion is supported by an increased venous extraction, while arterial P(O(2)) (Pa(O(2))) and haemoglobin saturation do not vary with digestive status. Thus, we predict that venous P(O(2)) (Pv(O(2))) is reduced from a fasting value of 5.2 kPa to 1.6 kPa during digestion.

Descriptors: reptiles, snakes, *Python molurus*, digestion, increased blood oxygen, metabolic rate, increase, arterial blood gases, hematological parameters.

Pafilis, P., J. Foufopoulos, N. Poulakakis, P. Lymberakis, and E. Valakos (2007). **Digestive performance in five Mediterranean lizard species: effects of temperature and insularity.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 177(1): 49-60. ISSN: print: 0174-1578; online: 1432-136X.

NAL Call Number: QP33.J681

Abstract: Temperature sensitivity of digestive processes has important ramifications for digestive performance in ectothermic vertebrates. We conducted a comparative analysis of temperature effects on digestive processes [gut passage times (GPTs) and apparent digestive efficiencies (ADEs)] in five lacertid lizards occurring in insular (*Podarcis erhardii, P. gaigeae*), and mainland (*P. muralis, P. peloponnesiaca, Lacerta graeca*) Mediterranean environments. GPTs were negatively correlated to temperature with mainland taxa having 10-20% longer GPTs than island taxa. In contrast to previous studies that estimate ADEs using bomb calorimetry, we compare ADEs by analyzing discrete efficiencies for lipids, sugars and proteins at three temperature regimes (20, 25, and 30 degrees C); each of these categories produces different results. ADEs for lipids and sugars showed a monotonic increase with temperature whereas ADEs for proteins decreased with temperature. Island taxa had consistently higher ADEs than their mainland counterparts for lipids and for proteins but not for sugars. They are characterized by superior energy acquisition abilities despite significantly shorter GPTs. Their increased digestive performance relative to the mainland species appears to allow them to maximize energy acquisition in unproductive island environments where food availability is spatially and seasonally clustered.

Descriptors: reptiles, Mediterranean lacertid lizards, digestive performance, effects of temperature, insularity, gut passage time, apparent digestive efficiencies.

Pan, Z.C., X. Ji, H.L. Lu, and X.M. Ma (2005). **Metabolic response to feeding in the Chinese striped-necked turtle, *Ocadia sinensis*.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 141(4): 470-475. ISSN: 1095-6433.

Abstract: We measured oxygen consumption in juvenile Chinese striped-necked turtles (*Ocadia sinensis*) after they ingested food, either as a single meal or as double meals, to examine the influence of meal type and feeding frequency on specific dynamic action (SDA). Temporal variation in oxygen consumption after feeding was evident in the ingesting turtles but not in the unfed control turtles. In the single-meal experiment, the peak metabolic rate and the integrated SDA response (the whole energetic cost for the processes of digestion) both did not differ between turtles ingesting mealworms and shrimps when the influence of variation in ingested energy was removed, and the time to reach peak metabolic rate was not affected by meal type and the amount of food ingested. Turtles in the double-meal experiment ingested more energy and hence had a prolonged duration of SDA response than did those in the single-meal experiment, but the integrated SDA response did not differ between both experimental treatments when the influence of variation in ingested energy was removed. Our results show that meal type and feeding frequency have important consequences on the SDA response of juvenile *O. sinensis*. As the integrated SDA response remained remarkably constant either between turtles ingesting different food or between turtles ingesting the same food but at different frequencies when the influence of variation in ingested energy was removed, we therefore conclude that the energetic cost associated with

ingestion is primarily determined by energy content of food ingested in juvenile *O. sinensis*.
Descriptors: young turtles , *Ocadia sinensis*, anatomy, histology, nutrition, physiology, body weight, digestion, energy intake, energy metabolism, feeding behavior, lipids chemistry, oxygen consumption, time factors, feeding, metabolic response, energy content, metabolic rate.

Paolucci, M., S. Buono, R. Sciarrillo, and R. Putti (2006). **Effects of leptin administration on the endocrine pancreas and liver in the lizard *Podarcis sicula*.** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 305(5): 383-395. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Abstract: In this study, we investigated the presence of leptin receptor in pancreatic islets and the effect of exogenous leptin administration in *Podarcis sicula* on glucose metabolism. Our data show the presence of leptin receptor immunoreactivity in the endocrine pancreas suggesting that leptin may act at a peripheral level as previously postulated in mammals. The effects of short- and long-term and dose-response treatment with supraphysiological concentrations of leptin on circulating levels of insulin, glucagon and glucose in the blood have been evaluated. Taken together, our results indicate that leptin treatment was followed by an increase in insulin, glucagon and glucose in the blood, depending on the dose of leptin. Moreover, leptin treatment brought about a decrease of glycogen and the appearance of tyrosine-phosphorylated proteins in the liver. This study shows that in the lizard *P. sicula* leptin is involved in glucose metabolism.
Descriptors: lizard, *Podarcis sicula*, islets of Langerhans drug effects, leptin pharmacology, liver drug effects, lizards physiology, blood glucose, dose response relationship, drug, electrophoresis, polyacrylamide gel, glucagon blood, immunohistochemistry, insulin blood, islets of langerhans metabolism, liver metabolism, liver extracts analysis, mice, receptors, cell surface metabolism.

Qian GuoYing and Zhu QiuHua (2003). **Effects of living space on nutrient components of Chinese soft-shelled turtle (*Trionyx sinensis*)**. *Acta Hydrobiologica Sinica* 27(2): 217-220. ISSN: 1000-3207.
NAL Call Number: QH540
Descriptors: reptiles, Chinese soft shelled turtle, *Trionyx sinensis*, living space, effects, nutrient componenets, husbandry, farmed animals.
Language of Text: Chinese.

Rocha, C.F., D. Vrcibradic, and M. Van Sluys (2004). **Diet of the lizard *Mabuya agilis* (Sauria; Scincidae) in an insular habitat (Ilha Grande, RJ, Brazil).** *Revista Brasleira De Biologia. [Brazilian Journal of Biology].* 64(1): 135-139. ISSN: 1519-6984.
Abstract: We examined the stomach contents of 21 specimens of *Mabuya agilis* (Sauria; Scincidae) collected during February 2001 at the restinga habitat of Praia do Sul, in Ilha Grande, RJ, Brazil. Diet was composed of various types of small arthropods, with no plant material being eaten. Spiders were the most important items in the diet, followed by orthopterans. Apart from the absence of isopterans, the diet of *Mabuya agilis* from this

insular area was similar to those of other conspecific mainland populations. This suggests that factors such as insularity and the absence of other small sympatric lizards may not have a significant effect on the feeding habits of the Praia do Sul population.
Descriptors: reptiles, diet, lizard, *Mabuya agilis*, food habits, physiology, gastrointestinal contents, Brazil.

Rogner, M. (2005). **Wasserschildkroeten Ueber ihre Unterbringung und Ernaehrung. [Turtles. Information on their care and feeding.]**. *Aquarium Bornheim* 431: 66-71. ISSN: 0341-2709.
Descriptors: reptiles, turtles, information, care, feeding, diet, housing.
Language of Text: German.

Saad, C.R., A.R. Alimon, H.H. Tong, and P. Roustaian (2003). **Practical diet evaluation with hatchlings of soft-shell turtle, *Trionyx sinensis* Wiegmann, in the tropics**. *Journal of Applied Ichthyology* 19(1): 62-63. ISSN: 0175-8659.
NAL Call Number: QL614.Z44
Descriptors: reptiles, soft shell turtle, *Trionyx sinensis*, hatchlings, practical diet evaluation, tropics.

Secor, S.M. (2005). **Evolutionary and cellular mechanisms regulating intestinal performance of amphibians and reptiles.** *Integrative and Comparative Biology* 45(2): 282-294. ISSN: print: 1540-7063; online: 1557-7023.
NAL Call Number: QL1.I67
Descriptors: reptiles, evolutionary, cellular, mechanisms, intestinal performance, regulating, amphibians.

Seney, E.E. and J.A. Musick (2005). **Diet analysis of Kemp's ridley sea turtles (*Lepidochelys kempii*) in Virginia.** *Chelonian Conservation and Biology* 4(4): 864-871. ISSN: 1071-8443.
Descriptors: reptiles, Kemp's ridley sea turtles, *Lepidochelys kempii*, diet analysis, diet, Virginia.

Stone, M.D. and D. Moll (2006). **Diet-dependent differences in digestive efficiency in two sympatric species of box turtles, *Terrapene carolina* and *Terrapene ornata*.** *Journal of Herpetology* 40(3): 364-371. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: reptiles, box turtles, *Terrapene carolina*, *Terrapene ornata*, digestive efficiency, diet dependent differences, digestive physiology.

Struck, U., A.V. Altenbach, M. Gaulke, and F. Glaw (2002). **Tracing the diet of the monitor lizard *Varanus mabitang* by stable isotope analyses (delta(15)N, delta(13)C).** *Die Naturwissenschaften* 89(10): 470-473. ISSN: print: 0028-1042; online: 1432-1904.
Abstract: In this study, we used analyses of stable isotopes of nitrogen (delta(15)N) and carbon (delta(13)C) to determine the trophic ecology of the monitor lizard *Varanus mabitang*. Stable isotopes from claws, gut contents, and soft tissues were measured from the type specimen. Samples from *Varanus olivaceus*, *Varanus prasinus*, *Varanus salvator*, the herbivorous

agamid lizard *Hydrosaurus pustulatus*, and some plant matter were included for comparison. Our data show a rapid decrease in delta(13)C (about 10 per thousand) from food plants towards gut contents and soft tissues of herbivorous species. For the varanids, we found a significant linear correlation of decreasing delta(13)C and increasing delta(15)N from herbivorous towards carnivorous species. In terms of trophic isotope ecology, the type specimen of *V. mabitang* is a strict herbivore. Thus it differs significantly in its isotopic composition from the morphologically next closest related species *V. olivaceus*. The most highly carnivorous species is *V. salvator*, while delta(15)N values for *V. prasinus* and *V. olivaceus* are intermediate. Claws provide very valuable samples for such measurements, because they can be sampled from living animals without harm. Additionally, their range of variability is relatively small in comparison with measurements from soft tissues.
Descriptors: reptiles, monitor lizard, *Varanus mabitang* , physiology, diet, animal feed, carbon isotopes, isotope labeling methods, nitrogen isotopes, Germany.

Su, Y., S.C. Fong, and M.C. Tu (2005). **Food habits of the sea snake, *Laticauda semifasciata*.** *Zoological Studies* 44(3): 403-408. ISSN: 1021-5506.
NAL Call Number: QL307.2.C54
Descriptors: reptiles, sea snake, *Laticauda semifasciata*, diet, food habits, feeding habits.

Thompson, M.B. and B.K. Speake (2002). **Energy and nutrient utilisation by embryonic reptiles.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 133(3): 529-538. ISSN: 1095-6433.
Abstract: Most reptiles are oviparous, with the developing embryos relying on the contents of the yolk to sustain development until hatching (lecithotrophy). The yolk is composed primarily of lipid and protein, which act as an energy source and the essential components to build embryonic tissue. Nevertheless, yolk and the resulting embryos contain many other nutrients, including inorganic ions, vitamins, carotenoids, water and hormones. Apart from water and oxygen, which may be taken up by eggs, and some inorganic ions that can come from the eggshell or even from outside the egg, everything required by the embryo must be in the egg when it is laid. Approximately 20% of squamate reptiles are viviparous, exhibiting a variety of placental complexities. Species with complex placentae have reduced yolk volumes, with the mother augmenting embryonic nutrition by provision across the placenta (placentotrophy). Despite assumed advantages of placentotrophy, only 5 out of approximately 100 lineages of viviparous squamates exhibit substantial placentotrophy. This paper reviews available and recent information on the yolk contents of a variety of squamate reptiles to ask the question, how are nutrients transported from the yolk to the embryo or across the placenta? Although, current available data suggest that, in broad terms, yolk is taken up by embryos without discrimination of the nutrients, there are some apparent exceptions, including the very long chain polyunsaturated fatty acids. In addition, fundamental differences in the patterns of energy utilisation in lizards and snakes suggest fundamental differences in lipid profiles in these taxa, which appear to reflect the differences between placentotrophic and lecithotrophic viviparous lizards.
Descriptors: reptiles, embryonic reptiles, energy, nutient, utilisation, yolk contents, placenta, nutrients, transport.

Toledo, L.F., A.S. Abe, and D.V. Andrade (2003). **Temperature and meal size effects on the postprandial metabolism and energetics in a boid snake.** *Physiological and Biochemical Zoology* 76(2): 240-246. ISSN: 1522-2152.

NAL Call Number: QL1.P52

Abstract: We investigated the combined effect of meal size and temperature on the aerobic metabolism and energetics of digestion in *Boa constrictor amarali.* Oxygen uptake rates (Vd2;o2) and the duration of the digestion were determined in snakes fed with meals equaling to 5%, 10%, 20%, and 40% of the snake's body mass at 25 degrees and 30 degrees C. The maximum Vd2;o2 values attained during digestion were greater at 30 degrees C than at 25 degrees C. Both maximal Vd2;o2 values and the duration of the specific dynamic action (SDA) were attained sooner at 30 degrees C than at 25 degrees C. Therefore, the temperature effect on digestion in Boa is characterized by the shortening of the SDA duration at the expense of increased Vd2;o2. Energy allocated to SDA was not affected by meal size but was greater at 25 degrees C compared to 30 degrees C. This indicates that a postprandial thermophilic response can be advantageous not only by decreasing the duration of digestion but also by improving digestive efficiency. Maximal Vd2;o2 and SDA duration increased with meal size at both temperatures.

Descriptors: reptiles, boid snake, *Boa constrictor amarali*, temperature, meal size, effects, postprandial metabolism, energetics.

Vincent, S.E., B.R. Moon, R. Shine, and A. Herrel (2006). **The functional meaning of "prey size" in water snakes (*Nerodia fasciata*, Colubridae).** *Oecologia* 147(2): 204-211. ISSN: 0029-8549.

NAL Call Number: QL750.O3

Abstract: The evolutionary success of macrostomatan (enlarged-gape) snakes has been attributed to their ability to consume large prey, in turn made possible by their highly kinetic skulls. However, prey can be "large" in several ways, and we have little insight into which aspects of prey size and shape affect skull function during feeding. We used X-ray videos of broad-banded water snakes (*Nerodia fasciata*) feeding on both frogs and fish to quantify movements of the jaw elements during prey transport, and of the anterior vertebral column during post-cranial swallowing. In a sample of additional individuals feeding on both frogs and fish, we measured the time and the number of jaw protractions needed to transport prey through the buccal cavity. Prey type (fish vs. frog) did not influence transport kinematics, but did influence transport performance. Furthermore, wider and taller prey induced greater movements of most cranial elements, but wider prey were transported with significantly less anterior vertebral bending. In the performance trials, heavier, shorter, and wider prey took significantly more time and a greater number of jaw protractions to ingest. Thus, the functional challenges involved in prey transport depend not only upon prey mass, but also prey type (fish vs. frog) and prey shape (relative height, width and length), suggesting that from the perspective of a gape-limited predator, the difficulty of prey ingestion depends upon multiple aspects of prey size.

Descriptors: water snakes, *Nerodia fasciata*, Colubridae anatomy and histology, Colubridae physiology, predatory behavior physiology, biomechanics, body size, head anatomy and histology, head physiology.

Warner, D.A., M.B. Lovern, and R. Shine (2007). **Maternal nutrition affects reproductive output and sex allocation in a lizard with environmental sex determination.** *Proceedings of the Royal Society of London. Series B, Biological Sciences* 274(1611): 883-890. ISSN: 0080-4649.
Abstract: Life-history traits such as offspring size, number and sex ratio are affected by maternal feeding rates in many kinds of animals, but the consequences of variation in maternal diet quality (rather than quantity) are poorly understood. We manipulated dietary quality of reproducing female lizards (*Amphibolurus muricatus*; Agamidae), a species with temperature-dependent sex determination, to examine strategies of reproductive allocation. Females maintained on a poor-quality diet produced fewer clutches but massively (twofold) larger eggs with lower concentrations of yolk testosterone than did conspecific females given a high-quality diet. Although all eggs were incubated at the same temperature, and yolk steroid hormone levels were not correlated with offspring sex, the nutrient-deprived females produced highly male-biased sex ratios among their offspring. These responses to maternal nutrition generate a link between sex and offspring size, in a direction likely to enhance maternal fitness if large body size enhances reproductive success more in sons than in daughters (as seems plausible, given the mating system of this species). Overall, our results show that sex determination in these animals is more complex, and responsive to a wider range of environmental cues, than that suggested by the classification of 'environmental sex determination'.
Descriptors: reptiles , female lizards, *Amphibolurus muricatus*, maternal nutrition, repoductive output, sex allocation, affects, sex determination.

Witberg, M. and G. Van Zyl (2006). ***Atractaspididae Homoroselaps lacteus* (Linnaeus, 1754) spotted harlequin snake diet/predation.** *African Herp News* 40: 21-23. ISSN: 1017-6187.
Descriptors: reptiles, spotted harlequin snake, diet, *Atractaspididae Homoroselaps lacteus*, predation.

Yang GongMing, Xu HuaiDe, Duan XuChang, and Li ZhiCheng (2003). **Study on the nutritional components of soft-shelled turtle**. *Acta Nutrimenta Sinica* 25(4): 443-445. ISSN: 0512-7955.
Descriptors: reptiles, soft shelled turtle, nutritionsl components, study, diet, food.
Language of Text: Chinese.

Zhang, F.Y. and H.X. Gu (2005). **Artificial feeding of baby turtle of *Chelonia mydas*.** *Sichuan Journal of Zoology* 24(3): 412-413. ISSN: 1000-7083.
Descriptors: reptiles, baby turtle, *Chelonia mydas*, diet, captivity, artificial feeding.
Language of Text: Chinese; Summary in Chinese and English.

Zhou, X., M. Xie, C. Niu, and R. Sun (2003). **The effects of dietary vitamin C on growth, liver vitamin C and serum cortisol in stressed and unstressed juvenile soft-shelled turtles (*Pelodiscus sinensis*).** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 135(2): 263-270. ISSN: 1095-6433.
Abstract: We studied the effect of dietary vitamin C on growth, liver vitamin C and serum cortisol levels in stressed and unstressed juvenile soft-shelled turtles. Turtles were fed with

vitamin C supplementation at dosages of 0, 250, 500, 2500, 5,000 or 10,000 mg/kg diet for 4 weeks. Vitamin C supplementation exerted significant effects on specific growth rate and liver vitamin C concentrations. The specific growth rate peaked in the group fed at 500 mg/kg diet, while liver vitamin C levels increased with increasing dietary vitamin C levels. Serum cortisol concentrations did not differ between groups of turtles fed diets supplemented with vitamin C in the range of 0-10,000 mg/kg. After acid stress, hepatic vitamin C levels were unaffected, while serum cortisol in the control group was significantly elevated (P<0.01). The other five groups of turtles did not show significant changes in serum cortisol compared with pre-stress levels.

Descriptors: reptiles, soft shelled turtles, *Pelodiscus sinensis*, dietary vitamin C, effects, growth, liver vitamin C, serum cortisol, stressed, unstressed, juveniles.

Zhou, X.Q., C.J. Niu, and R.Y. Sun (2005). **The effect of vitamin C on stress withstanding capability in the juvenile soft-shelled turtle (*Pelodiscus sinensis*).** *Aquaculture Nutrition* 11(3): 169-174. ISSN: 1353-5773.

NAL Call Number: SH156.A658

Descriptors: reptiles, turtle culture, soft-shelled turtle, *Pelodiscus sinensis*, juveniles, ascorbic acid, dietary supplements, erythrocytes, phagocytosis, animal stress, pH, water quality, blood serum, *Vibrio parahaemolyticus* , antimicrobial agents, disease control, *Pelodiscus sinensis*, acid stress.

Zhou XiaoQiu, Yang Feng, Zhou AnGuo, Cai JingYi, and Yan BenJu (2003). **Methionine requirement of juvenile Chinese soft shell turtle**. *Acta Hydrobiologica Sinica* 27(1): 69-73. ISSN: 1000-3207.

NAL Call Number: QH540

Abstract: 90 juvenile Chinese soft shell turtles (initial weight, 17.64+or-0.25 g) were divided into six groups and were fed with semipurified diets (cystine content, 0.56%) having different methionine contents (i.e., 0.82%, 1.12%, 1.32%, 1.52%, 1.72%, 2.02%) for 45 days. The experimental diets consisted of white fish meal, liver meal, soya protein meal, gluten, fish oil, corn oil, sucrose, alpha -starch, and premixtures of amino acids, vitamins and minerals. The liveweight, liver weight, body fat content, and body methionine content were determined at the end of the feeding trial. Significant differences in growth rate, feed conversion rate, liver weight/body weight ratio, and methionine retention rate were observed among turtle groups fed the diets with different methionine contents (P<0.01). Significant differences were also noted in the feed intake, liver weight, body fat content and protein retention rate of turtles fed different methionine levels (P<0.05). No significant difference in body protein content was observed among groups. Thus, the methionine requirement of the juvenile soft shell turtle is 1.28 (dietary base) or 3.07% (protein base), based on a diet containing 0.56% cystine. *Courtesty of CAB Abstracts.*

Descriptors: reptiles, Chineses soft shell turtle, *Pelodiscus sinensis*, methionine requirement, juvenile, diets.

Language of Text: Chinese; Summary in English.

Diseases

Afonso, C.L., E.R. Tulman, G. Delhon, Z. Lu, G.J. Viljoen, D.B. Wallace, G.F. Kutish, and D.L. Rock (2006). **Genome of crocodilepox virus.** *Journal of Virology* 80(10): 4978-4991. ISSN: 0022-538X.

NAL Call Number: QR360.J6

Abstract: Here, we present the genome sequence, with analysis, of a poxvirus infecting Nile crocodiles (*Crocodylus niloticus*) (crocodilepox virus; CRV). The genome is 190,054 bp (62% G+C) and predicted to contain 173 genes encoding proteins of 53 to 1,941 amino acids. The central genomic region contains genes conserved and generally colinear with those of other chordopoxviruses (ChPVs). CRV is distinct, as the terminal 33-kbp (left) and 13-kbp (right) genomic regions are largely CRV specific, containing 48 unique genes which lack similarity to other poxvirus genes. Notably, CRV also contains 14 unique genes which disrupt ChPV gene colinearity within the central genomic region, including 7 genes encoding GyrB-like ATPase domains similar to those in cellular type IIA DNA topoisomerases, suggestive of novel ATP-dependent functions. The presence of 10 CRV proteins with similarity to components of cellular multisubunit E3 ubiquitin-protein ligase complexes, including 9 proteins containing F-box motifs and F-box-associated regions and a homologue of cellular anaphase-promoting complex subunit 11 (Apc11), suggests that modification of host ubiquitination pathways may be significant for CRV-host cell interaction. CRV encodes a novel complement of proteins potentially involved in DNA replication, including a NAD(+)-dependent DNA ligase and a protein with similarity to both vaccinia virus F16L and prokaryotic serine site-specific resolvase-invertases. CRV lacks genes encoding proteins for nucleotide metabolism. CRV shares notable genomic similarities with molluscum contagiosum virus, including genes found only in these two viruses. Phylogenetic analysis indicates that CRV is quite distinct from other ChPVs, representing a new genus within the subfamily Chordopoxvirinae, and it lacks recognizable homologues of most ChPV genes involved in virulence and host range, including those involving interferon response, intracellular signaling, and host immune response modulation. These data reveal the unique nature of CRV and suggest mechanisms of virus-reptile host interaction.

Descriptors: alligators and crocodiles virology, Chordopoxvirinae genetics, genome, viral, multigene family, adenosine triphosphatases chemistry, adenosine triphosphatases genetics, amino acid sequence, chordopoxvirinae enzymology, DNA gyrase chemistry, DNA gyrase genetics, molecular sequence data, phylogeny, protein structure, tertiary, sequence alignment, sequence analysis, DNA, sequence homology, amino acid, ubiquitin protein ligases genetics.

Alleman, A.R. and E.K. Kupprion (2007). **Cytologic diagnosis of diseases in reptiles.** *Veterinary Clinics of North America, Exotic Animal Practice* 10(1): 155-186. ISSN: 1094-9194.

NAL Call Number: SF997.5.E95 E97

Abstract: The cytologic evaluation of samples obtained from reptile patients may provide invaluable diagnostic information to the clinician. The following article is directed toward providing information regarding the techniques used to obtain samples, discussion of sample

types, and guidelines for the cytologic classification of the materials collected from tissue lesions and body fluids.
Descriptors: reptiles, cytodiagnosis, veterinary, animal diseases, samples, techniques, guidelines, tissue lesions, body fluids.

Barten, S.L. (2002). **Diseases of the Iguana oral cavity.** *Proceedings of the North American Veterinary Conference* 16(16): 894-895. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: iguana, mouth diseases, oral cavity, reptiles, conference proceedings.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Bauwens, L., F. Vercammen, S. Bertrand, J.M. Collard, and S. De Ceuster (2006). **Isolation of *Salmonella* from environmental samples collected in the reptile department of Antwerp Zoo using different selective methods.** *Journal of Applied Microbiology* 101(2): 284-289. ISSN: 1364-5072.
NAL Call Number: QR1.J687
Abstract: To evaluate the environmental spread of *Salmonella* strains in the reptile department of Antwerp Zoo and to compare different isolation methods for *Salmonella*. One hundred environmental samples were collected in the service sections and public spaces of the reptile department. After pre-enrichment in buffered peptone water (BPW), selective enrichment was performed in Rappaport Vassiliadis Single Component Enrichment Broth (RVS), Selenite Cystine Broth (SEL) and Mueller Kauffman Tetrathionate Broth (MKTTn). Subculturing on Modified Semisolid Rappaport-Vassiliadis (MSRV) Medium, and the combined use of immunomagnetic separation (IMS) and RVS was evaluated. The isolation media used were Hektoen Enteric Agar (HE), Phenol Red Brilliant Green Agar (BG) and Xylose Lysine Decarboxylase Agar (XLD). *Salmonella* strains were found in 47 samples (47* diaeresis *0%). Most isolations were made on HE after combined IMS/RVS enrichment. Sixty-six *Salmonella* strains were serotyped, 29 belonged to *Salmonella enterica* ssp. enterica (I), 3 to ssp. salamae (II), 29 to ssp. arizonae or diarizonae (IIIa/b), 4 to ssp. houtenae (IV) and 1 strain showed autoagglutination. In addition, a 10-year survey (1995-2004) of *Salmonella* serovars isolated from reptiles at Antwerp Zoo is presented. A high prevalence of *Salmonella* strains was noted in the service sections of the reptile department. Only a few isolations were made in the public spaces. Selective enrichment in RVS was the most efficient. In combination with IMS, this method gave an even higher isolation rate than the International Standard method (ISO 6579:2002). This study confirms the importance of reptiles as spreaders of *Salmonella* in their surroundings. The possible infectious risks for zoo personnel and visitors are evaluated. Improved laboratory protocols for the isolation of *Salmonella* from the environment are suggested.
Descriptors: reptiles, *Salmonella enterica*, isolation, spread, enviromental samples, Antwerp zoo, strains, infectious risk, personnel, Belgium.

Beck, W. (2003). **Praxisrelevante Ektoparasitosen und Dermatophytosen bei kleinen Heimsaugern, Vogeln und Reptilien. [Common ectoparasitic diseases and dermatophytoses in small mammals, birds and reptiles].** *Praktische Tierarzt* 84(10): 752-762. ISSN: 0032-681X.
NAL Call Number: 41.8 P882
Descriptors: reptiles, common ectoparasitic diseases, dermatophytoses, birds, small mammals, diagnosis, treatment.
Language of Text: German; Summary in English.

Benko, M., P. Elo, K. Ursu, W. Ahne, S.E. LaPatra, D. Thomson, and B. Harrach (2002). **First molecular evidence for the existence of distinct fish and snake adenoviruses.** *Journal of Virology* 76(19): 10056-10059. ISSN: 0022-538X.
NAL Call Number: QR360.J6
Abstract: From adenovirus-like viruses originating from a fish and a snake species, a conserved part of the adenoviral DNA polymerase gene was PCR amplified, cloned and sequenced. Phylogenetic analysis showed that the snake adenovirus is closely related to the members of the proposed genus Atadenovirus, whereas the fish isolate seems to represent a separate cluster, likely a new genus.
Descriptors: reptiles, snake, adenoviruses, molecular evidence , DNA, phylogenetic analysis.

Bodetti, T.J., E. Jacobson, C. Wan, L. Hafner, A. Pospischil, K. Rose, and P. Timms (2002). **Molecular evidence to support the expansion of the hostrange of *chlamydophila pneumoniae* to include reptiles as well as humans, horses, koalas and amphibians**. *Systematic and Applied Microbiology* 25(1): 146-152. ISSN: 0723-2020.
NAL Call Number: QR1.Z42
Descriptors: amphibians, reptiles, horses, koalas, humans, host range expansion, molecular evidence, *Chlamydophila pneumoniae.*

Brown, D.R. (2002). **Mycoplasmosis and immunity of fish and reptiles.** *Frontiers in Bioscience* 7: D1338-D1346. ISSN: print: 1093-9946; online: 1093-4715.
Online: http://dx.doi.org/10.2741/brown
Abstract: Advances in molecular phylogenetics have enabled reconstruction of the most likely chronology of events in prokaryotic evolution and correlation with the paleontologic record with increasing precision. Mycoplasmas probably evolved from clostridial ancestors by genome reduction leading to obligate parasitism of host cells. The vertebrate hosts present at the time of the origin of mycoplasmas about 400 million years ago were fish, and later amphibians and reptiles, whose descendants possess most elements of vertebrate innate and adaptive immunity. Successful colonization of those poikilothermous ("cold-blooded") hosts must have involved adaptation to those defenses, shaping mycoplasma-host interactions for more than 125 million years before the earliest emergence of mammals. That history illuminates one aspect of the potential significance of mycoplasmosis of poikilothermous vertebrates to health and disease of other hosts including humans.
Descriptors: reptiles, fish, mycoplasmosis, immunity, poikilothermous vertebrates, parasitism, host cells.

Brown, D.R., D.L. Demcovitz, D.R. Plourde, S.M. Potter, M.E. Hunt, R.D. Jones, and D.S. Rotstein (2006). ***Mycoplasma iguanae* sp. nov., from a green iguana (*Iguana iguana*) with vertebral disease.** *International Journal of Systematic and Evolutionary Microbiology* 56(Pt 4): 761-764. ISSN: print: 1466-5026; online: 1466-5034.

Abstract: Strain 2327T, first cultured from vertebral abscesses of green iguanas (*Iguana iguana*) collected in Florida, USA, was readily distinguished from all previously described mollicutes by 16S rRNA gene sequence comparisons. Strain 2327T lacks a cell wall, ferments glucose, does not hydrolyse arginine, aesculin or urea and is sensitive to digitonin. Western blots distinguished the novel isolate serologically from the most closely related members of the Mycoplasma neurolyticum cluster. On the basis of these data, the isolate represents a novel species for which the name Mycoplasma iguanae sp. nov. is proposed. The type strain is strain 2327T (=ATCC BAA-1050T = NCTC 11745T).

Descriptors: *Iguana iguana*, iguanas microbiology, mycoplasma infections, molecular sequence data, phylogeny, ribosomal RNA, genetics, DNA sequence analysis.

Brown, D.R., J.L. Merritt, E.R. Jacobson, P.A. Klein, J.G. Tully, and M.B. Brown (2004). ***Mycoplasma testudineum* sp. nov., from a desert tortoise (*Gopherus agassizii*) with upper respiratory tract disease**. *International Journal of Systematic and Evolutionary Microbiology* 54(5): 1527-1529. ISSN: print: 1466-5026; online: 1466-5034.

Descriptors: reptiles, desert tortoise, *Mycoplasma testudineum* sp., upper respiratory tract disease, *Gopherus agassizii.*

Brown, D.R., L.A. Zacher, and D.A. Carbonneau (2005). **Seroprevalence of *Mycoplasma alligatoris* among free-ranging alligators (*Alligator mississippiensis*) in Florida - 2003.** *Journal of Zoo and Wildlife Medicine* 36(2): 340-341. ISSN: 1042-7260.

NAL Call Number: SF601.J6

Descriptors: reptiles, *Alligator mississippiensis*, *Mycoplasma alligatoris*, seroprevalence, free ranging alligators, Florida.

Buenviaje, G.N., J.M. Millan, P.M. Summers, and R.G. Hirst (2004). **Use of copper sulphate for the treatment of dermatophilosis ('brown spot' disease) in farmed crocodiles.** *Australian Veterinary Journal* 82(9): 577-578. ISSN: 0005-0423.

NAL Call Number: 41.8 Au72

Descriptors: reptiles, crocodiles, alternative livestock, animal diseases, skin diseases , copper sulfate, drug therapy, *Dermatophilus*, bacterial infections, formaldehyde, *Crocodylus porosus*, drug evaluation, skin lesions, mycoses, mixed infection, dermatophilosis.

Carter, S.L., B.D. Horne, D.W. Herman, D.K. Nichols, C.A. Haas, and J.C. Mitchell (2005). **Bacterial pneumonia in free-ranging bog turtles, *Glyptemys muhlenbergii* , from North Carolina and Virginia.** *Journal of the North Carolina Academy of Science* 121(4): 170-173.

NAL Call Number: Q11 .J6817

Descriptors: reptiles, bog turtles, free ranging, *Glyptemys muhlenbergii*, bacterial pneumonia, case report, North Carolina, Virginia.

Coberley, S.S., R.C. Condit, L.H. Herbst, and P.A. Klein (2002). **Identification and expression of immunogenic proteins of a disease-associated marine turtle herpesvirus.** *Journal of Virology* 76(20): 10553-10558. ISSN: 0022-538X.
NAL Call Number: QR360.J6
Abstract: Herpesviruses are associated with several diseases of marine turtles, including lung-eye-trachea disease (LETD) and fibropapillomatosis. Two approaches were used to identify immunodominant antigens of LETV, the LETD-associated herpesvirus. The first approach targeted glycoprotein B, which is known to be immunogenic and neutralizing in other species. The second strategy identified LETV proteins recognized on Western blots by antibodies in immune green turtle plasma. A 38-kDa protein was resolved by two-dimensional gel electrophoresis, sequenced, and identified as a scaffolding protein encoded by the overlapping open reading frames of UL26 and UL26.5. Glycoprotein B and the scaffolding protein were cloned and expressed in *Escherichia coli.* The expressed proteins were recognized on Western blots by antibodies in immune green turtle plasma. Phylogenetic studies based on UL26, DNA polymerase, and glycoprotein B revealed that LETV clusters with the alphaherpesviruses.
Descriptors: reptiles, marine turtle herpesvirus, immunogenic proteins, disease associated, lung-eye-trachea disease, LETD, identification.

Cooper, J.E. (2003). **Skin diseases of reptiles**. *Veterinary Times* 33(23): 12-13. ISSN: 1352-9374.
Descriptors: reptiles, skin diseases, abscesses, dermatitis, diagnosis, ectoparasites, treatment, neoplasms, lesions.

Corrente, M., K.G. Friedrich, A. Madio, C. Desario, V. Tiri, and M. Campolo (2003). **Comparison of different cultural media for the recovery of *Salmonella* strains from reptile faeces**. In: *Erkrankungen der Zootiere: Verhandlungsbericht des 41 Internationalen Symposiums uber die Erkrankungen der Zoo und Wildtiere. [Proceedings of the Institute for Zoo and Wildlife Research, Berlin, No.5],May 28, 2003-June 1, 2003, Rome, Italy,* p. 345.
Descriptors: reptiles, *Salmonella*, cultural media, comparison, reptile feces, strains.

D' Agostino, C., A. Lanza, C. Nannetti, G.M. Damiani, C. Tarantino, and S. Perrucci (2003). **Criptosporidiosi nei rettili. [Cryptosporidiosis in reptiles].** *Obiettivi e Documenti Veterinari* 24(2): 43-46. ISSN: 0392-1913.
Descriptors: reptiles, snake, lizard, turtles, cryptosporidosis , diagnosis, fecal exam, *Cryptosporidium serpentis*, *C. saurophylum*, disease.
Language of Text: Italian.

De Voe, R., K. Geissler, S. Elmore, D. Rotstein, G. Lewbart, and J. Guy (2004). **Ranavirus-associated morbidity and mortality in a group of captive eastern box turtles (*Terrapene carolina carolina*).** *Journal of Zoo and Wildlife Medicine* 35(4): 534-543. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Abstract: Seven captive eastern box turtles (*Terrapene carolina carolina*) from a large collection of North American chelonians in North Carolina became acutely ill in the fall of 2002. Five of the turtles died. Clinical signs included cutaneous abscessation, oral ulceration or

abscessation (or both), respiratory distress, anorexia, and lethargy. The predominant postmortem lesion was fibrinoid vasculitis of various organs, including skin, mucous membranes, lungs, and liver. No inclusion bodies were detected by histopathology or electron microscopy of formalin-fixed tissue. An iridovirus was isolated from tissues obtained postmortem from two of the box turtles that died. The virus was characterized by electron microscopy, polymerase chain reaction, and sequence analysis of a portion of the major capsid protein as a member of the genus Ranavirus.
Descriptors: reptiles, captive eastern box turtles, morbidity, mortality, ranavirus, clinical signs, postmortem lesions, iridovirus, case study.

DeNardo, D.F. (2004). **Stress and its influence on clinical disease in reptiles**. *Proceedings of the North American Veterinary Conference* 18: 1326-1328. ISSN: 0341-6953.
NAL Call Number: SF605.N672
Descriptors: reptiles, stress, influence on clinical disease , restraint.
Notes: In the volume: Small Animal and Exotics Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Drury, S.E., R.E. Gough, and D.B. Welchman (2002). **Isolation and identification of a reovirus from a lizard, *Uromastyx hardwickii*, in the United Kingdom.** *Veterinary Record* 151(21): 637-638. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, lizard, *Uromastyx hardwickii*, reovirus, isolation and identification, UK.

Dsouli, N., H. Younsi Kabachii, D. Postic, S. Nouira, L. Gern, and A. Bouattour (2006). **Reservoir role of lizard *Psammodromus algirus* in transmission cycle of *Borrelia burgdorferi sensu lato* (Spirochaetaceae) in Tunisia.** *Journal of Medical Entomology* 43(4): 737-742. ISSN: 0022-2585.
NAL Call Number: 421 J828
Abstract: To investigate the reservoir role of the lizard *Psammodromus algirus* for the Lyme disease spirochete, 199 lizards were trapped from April to October 2003 in El Jouza, northwestern Tunisia. In this site, the infection rate of free-living *Ixodes ricinus* (L.) by Borrelia was evaluated by immunofluorescence as 34.6% for adult ticks and 12.5% for nymphs. Eighty percent of P. algirus (117/146) captured during this study were infested by *I. ricinus*, the predominant tick species collected from lizards. The intensity of tick infestation of this host by larvae and nymphs ranged from 0.14 to 7.07 and from 1.5 to 6.58, respectively. These immature stages of *I. ricinus* were found on lizards in spring and the beginning of summer, with a peak of intensity during June (10.16 immature ticks by lizard). Tissue cultures from lizards and xenodiagnosis with larval *I. ricinus* were used to assess the infection and the ability, respectively, of infected lizards to transmit Borrelia to naive ticks. Seventeen percent of xenodiagnostic ticks (40/229) acquired *B. lusitaniae* while feeding on *P. algirus*. Therefore, we demonstrated the ability of the lizards to sustain Borrelia infection and to infect attached ticks, and we proved that *P. algirus* is a reservoir host competent to transmit *B. lusitaniae.*
Descriptors: lizard, *Psammodromus algirus*, *Borrelia burgdorferi*, physiology, disease reser-

voirs, *Ixodes*, lizards parasitology, Lyme disease, arachnid vectors, lyme disease transmission, polymerase chain reaction methods, tick infestations, epidemiology, Tunisia.

Ebani, V.V., D. Cerri, F. Fratini, N. Meille, P. Valentini, and E. Andreani (2005). ***Salmonella enterica* isolates from faeces of domestic reptiles and a study of their antimicrobial in vitro sensitivity.** *Research in Veterinary Science* 78(2): 117-121. ISSN: 0034-5288.
NAL Call Number: 41.8 R312
Abstract: From October 2001 to February 2002, the faecal samples of 305 reptiles (165 saurians, 99 ophidians and 41 chelonians) were bacteriologically examined to detect *Salmonella enterica*. *S. enterica* was isolated from 73 (23.93%) faecal samples including 44 (60.27%) samples collected from saurians, 15 (20.55%) from chelonians and 14 (19.18%) from ophidians; considering the number of samples taken for each reptile group, *S. enterica* was isolated from the 36.58% of chelonians, 26.66% of saurians and 14.14% of ophidians. The isolates were distributed among 38 serotypes. Sixty-nine (94.52%) isolates were resistant to erythromycin. About one-third of the isolates was resistant to sulfisoxazole (35.61%), gentamycin (32.88%), amoxycillin (31.51%) and ampicillin (27.40%). All but one of the isolates were sensitive to chloramphenicol. A high percentages of isolates were sensitive to enrofloxacin (84.93%), nitrofurantoin (80.82%), trimethoprim (76.71%) and tetracycline (75.34%).
Descriptors: reptiles, fecal testing, anti bacterial agents, pharmacology, microbiology, *Salmonella* infections, *Salmonella enterica*, drug effects, sensitivity tests, serotyping, veterinary.

Eggenschwiler, U. (2004). **Respiratory diseases in turtles: recognition, treatment and prevention.** *Reptilia GB* 34: 70-73. ISSN: 1138-4913.
Descriptors: reptiles, turtles, respiratory diseases, recognition, prevention, treatment.

Eisenberg, T. (2004). ***Salmonella* in reptiles.** *Reptilia GB* 33: 21-26. ISSN: 1138-4913.
Descriptors: reptiles, *Salmonella*, diseases, diagnosis, treatment.

Ene, A., M. Su, S. Lemaire, C. Rose, S. Schaff, R. Moretti, J. Lenz, and L.H. Herbst (2005). **Distribution of chelonid fibropapillomatosis-associated herpesvirus variants in Florida: molecular genetic evidence for infection of turtles following recruitment to neritic developmental habitats.** *Journal of Wildlife Diseases* 41(3): 489-497. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Abstract: Marine turtle fibropapillomatosis is associated with chelonid fibropapilloma-associated herpesvirus (C-FP-HV) and commonly affects juvenile green turtles (*Chelonia mydas*) in neritic (nearshore) habitats. Green turtles have a complex life history, characterized by shifts in trophic level as well as habitat during ontogeny. Thus, several hypotheses can be proposed for when turtles become infected with C-FP-HV. They may acquire the virus at an early stage in the life cycle, including prenatal, hatchling, or the posthatchling pelagic stages. Alternatively, they may become infected later in life after they emigrate from the open ocean to neritic habitats. Each hypothesis generates predictions about the spatial distribution of genetic variants of C-FP-HV among nearshore sites within a region. Sequencing of polymerase chain reaction-amplified viral DNA from fibropapillomas of individual turtles was used to genotype the viral variants present in marine turtles from different coastal areas

in Florida. We found four distinct virus variants (A, B, C, and D), two of which (A and C) were present in multiple turtle species. Green turtles in Florida were infected with variants A, B, and C. Variant A was found in green turtles from all three areas. Outside the Indian River Lagoon, variant A was most commonly detected and was found in >94% of diseased green turtles and 70% of loggerhead sea turtles (*Caretta caretta*) in the Florida Bay/Florida Keys. However, in the Indian River Lagoon, variant B was found in >94% of affected green turtles. Variant B was not detected outside of the Indian River system. Chi-square analysis strongly supported (P<0.001) an association between viral variant distribution in green turtles and location. On the basis of the assumption that juvenile green turtles found in Florida's west-central coast, Florida Keys, and Indian River Lagoon areas represented recruits from a mixed pelagic population, we expected that the distribution of viral variants in these turtles would be relatively homogeneous among locations; this would correspond to infection in the earlier phases of their life cycle. The heterogeneous distribution of viral variants in green turtle tumors from different Florida coastal locations strongly supports the hypothesis that, during epizootics, turtles are infected with specific C-FP-HV variants after they arrive as juveniles in neritic habitats. The conclusion that C-FP-HV is acquired after turtles recruit to nearshore habitats should help focus further research efforts on understanding the mechanisms of transmission and raises the possibility that the effect of fibropapillomatosis on turtle populations might be reduced by management strategies designed to break the cycle of transmission in these locations.

Descriptors: green turtles, *Chelonia mydas*, herpesevirus, herpesviridae infections, veterinary, skin neoplasms, tumor virus infections, turtles virology, base sequence, DNA, viral analysis, fibropapilloma, viral classification, fibroma virology, epidemiology, Florida.

Farfan Ale, J.A., B.J. Blitvich, N.L. Marlenee, M.A. Lorono Pino, F. Puerto Manzano, J.E. Garcia Rejon, E.P. Rosado Paredes, L.F. Flores Flores, A. Ortega Salazar, J. Chavez Medina, J.C. Cremieux Grimaldi, F. Correa Morales, G. Hernandez Gaona, J.F. Mendez Galvan, and B.J. Beaty (2006). **Antibodies to West Nile virus in asymptomatic mammals, birds, and reptiles in the Yucatan Peninsula of Mexico.** *American Journal of Tropical Medicine and Hygiene.* 74(5): 908-914. ISSN: 0002-9637.

Online: http://www.ajtmh.org/cgi/content/abstract/74/5/908?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&author1=farfan&fulltext=west+nile&andorexactfulltext=and&searchid=1&FIRSTINDEX=0&sortspec=relevance&resourcetype=HWCIT

Abstract: Surveillance for evidence of West Nile virus (WNV) infection in taxonomically diverse vertebrates was conducted in the Yucatan Peninsula of Mexico in 2003 and 2004. Sera from 144 horses on Cozumel Island, Quintana Roo State, 415 vertebrates (257 birds, 52 mammals, and 106 reptiles) belonging to 61 species from the Merida Zoo, Yucatan State, and 7 farmed crocodiles in Ciudad del Carmen, Campeche State were assayed for antibodies to flaviviruses. Ninety (62%) horses on Cozumel Island had epitope-blocking enzyme-linked immunosorbent assay (ELISA) antibodies to flaviviruses, of which 75 (52%) were seropositive for WNV by plaque reduction neutralization test (PRNT). Blocking ELISA antibodies to flaviviruses also were detected in 13 (3%) animals in the Merida Zoo, including 7 birds and 2 mammals (a jaguar and coyote) seropositive for WNV by PRNT. Six (86%) crocodiles in Campeche State had PRNT-confirmed WNV infections. All animals were healthy at the

time of serum collections and none had a history of WNV-like illness.
Descriptors: mammals, birds, reptiles, viral analysis of antibodies, West Nile fever, wild animals, enzyme linked immunosorbent assay, Mexico, seroepidemiologic studies.

Farkas, S.L. (2004). **Hullok adenovirusai. [Adenoviruses of reptiles].** *Magyar Allatorvosok Lapja* 126(4): 212-216. ISSN: 0025-004X.
Descriptors: reptiles, adenoviruses, lizards, snakes, aligators, turtles, tortoises.
Language of Text: Hungarian; Summary in English.

Feldman, S.H., J. Wimsatt, R.E. Marchang, A.J. Johnson, W. Brown, J.C. Mitchell, and J.M. Sleeman (2006). **A novel Mycoplasma detected in association with upper respiratory disease syndrome in free-ranging eastern box turtles (*Terrapene carolina carolina*) in Virginia.** *Journal of Wildlife Diseases* 42(2): 279-289. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Abstract: Clinical signs of upper respiratory tract disease-like syndrome (URTD-LS) were observed in free-ranging eastern box turtles (*Terrapene carolina carolina*) from Virginia, USA (May 2001-August 2003), some of which also had aural abscesses. After a Mycoplasma sp. was detected by polymerase chain reaction (PCR), a study was undertaken to better define the range of clinical signs of disease and to distinguish mycoplasma-associated URTD-LS from other suspected causes of URTD-LS and aural abscessation in box turtles. Nasal and/or ocular swabs (from turtles possessing URTD-LS) or nasal washes (from asymptomatic turtles) were collected from turtles May 2001-August 2003; samples were assayed for Mycoplasma spp., chelonian herpesvirus, and iridoviruses by PCR testing. A partial DNA sequence (933 bases) of the small ribosomal subunit (16S rRNA) of the box turtle Mycoplasma sp. was analyzed to determine its phylogenetic relatedness to other Mycoplasma spp. of veterinary interest. Mycoplasma sp. was detected in seven (six with clinical signs of URTD-LS; one asymptomatic) of 23 fortuitously collected animals from six of 11 Virginia counties. Clinical signs in Mycoplasma sp.-infected animals included unilateral to bilateral serous to mucopurulent nasal discharge, epiphora, ocular edema, and conjunctival injection. Five Mycoplasma sp.-positive animals possessed aural abscesses; two did not. Analysis of the mycoplasma 16S rRNA gene sequence from one asymptomatic and three symptomatic animals representing four counties revealed a consensus Mycoplasma sp. sequence closely related to, but distinct from, *M. agassizii*. None of the samples collected contained viral DNA of chelonian herpesviruses or invertebrate and vertebrate (including FV3) iridoviruses. In conclusion, a new Mycoplasma sp. was associated with URTD-LS in native box turtles from Virginia that was not codetected with other suspected causes of chelonian upper respiratory disease; there was no proof of a direct relationship between aural abscessation and the Mycoplasma sp.
Descriptors: reptiles , eastern box turtles, *Terrapene carolina carolina*, Mycoplasma infections, polymerase chain reaction, respiratory tract infections, microbiology, DNA, bacterial analysis, respiratory tract infections, epidemiology, pathology, Virginia.

Filip, T. and A. Kuebber Heiss (2005). **Ein Update zur Herpesvirose bei Schildkroeten. [An update on the herpes virus in tortoises & turtles.]**. *Marginata* 7: 36-43.
Descriptors: reptiles, tortoises, turtles, herpes virus, disease, update.
Language of Text: German.

Foley, A.M., B.A. Schroeder, A.E. Redlow, K.J. Fick Child, and W.G. Teas (2005). **Fibropapillomatosis in stranded green turtles (*Chelonia mydas*) from the eastern United States (1980-98): trends and associations with environmental factors.** *Journal of Wildlife Diseases* 41(1): 29-41. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Abstract: We examined data collected by the US Sea Turtle Stranding and Salvage Network on 4,328 green turtles (*Chelonia mydas*) found dead or debilitated (i.e., stranded) in the eastern half of the USA from Massachusetts to Texas during the period extending from 1980 to 1998. Fibropapillomatosis (FP) was reported only on green turtles in the southern half of Florida (south of 29 degrees N latitude). Within this region, 22.6% (682/3,016) of the turtles had tumors. Fibropapillomatosis was more prevalent in turtles found along the western (Gulf) coast of Florida (51.9%) than in turtles found along the eastern (Atlantic) coast of Florida (11.9%) and was more prevalent in turtles found in inshore areas (38.9%) than in turtles found in offshore areas (14.6%). A high prevalence of FP corresponded to coastal waters characterized by habitat degradation and pollution, a large extent of shallow-water area, and low wave energy, supporting speculation that one or more of these factors could serve as an environmental cofactor in the expression of FP. A high prevalence of FP did not correspond to high-density green turtle assemblages. Turtles with tumors were found most commonly during the fall and winter months, and the occurrence of tumors was most common in turtles of intermediate size (40-70-cm curved carapace length). Stranded green turtles with tumors were more likely to be emaciated or entangled in fishing line and less likely to have propeller wounds than were stranded green turtles without tumors. Turtles with and without tumors were equally likely to show evidence of a shark attack. The percent occurrence of tumors in stranded green turtles increased from approximately 10% in the early 1980s to over 30% in the late 1990s. Fibropapillomatosis was first documented in southernmost Florida in the late 1930s and spread throughout the southern half of Florida and the Caribbean during the mid-1980s. Because green turtles living in south Florida are known to move throughout much of the Caribbean, but are not known to move to other parts of the USA or to Bermuda, the spread and current distribution of FP in the western Atlantic, Gulf of Mexico, and Caribbean can be explained by assuming FP is caused by an infectious agent that first appeared in southern Florida. Aberrant movements of captive-reared turtles or of turtles that are released into areas where they were not originally found could spread FP beyond its current distribution.
Descriptors: green turtles , *Chelonia mydas*, environmental pollution, adverse effects, fibropapillomatosis, papilloma, skin neoplasms, epidemiology, fibroma etiology, pathology, geography, papilloma epidemiology, etiology, pathology, prevalence, seasons.

Gal, J. (2004). **A hullok verkepzo es keringesi szerveinek fontosabb megbetegedesei. [Major diseases of hemopoetic and circulatory systems of reptiles].** *KisallatPraxis* 5(3): 134-136. ISSN: 1585-9142.
NAL Call Number: SF981.K573
Descriptors: reptiles, major diseases, hemopoetic system, circulatory system.
Language of Text: Hungarian; Summary in English.

Gal, J., M. Mandoki, C. Jakab, E. Sos, and M. Marosan (2003). **Entamoebosis zold leguanban (*Iguana iguana*).[Entamoebiosis in green iguana (*Iguana iguana*)].** *Magyar Allatorvosok Lapja* 125(7): 422-424. ISSN: 0025-004X.
Descriptors: reptiles, iguana, case reports, entamoebosis, clinical aspects.
Language of Text: Hungarian; Summary in English.

Gal, J., M. Marosan, and D. Winkler (2004). **A hullok kivalaszto keszulekenek anatomiaja, elettana es fontosabb megbetegedesei. [Anatomy, physiology and major diseases of the reptile excretory apparatus].** *KisallatPraxis* 5(1): 22, 24-26. ISSN: 1585-9142.
NAL Call Number: SF981.K573
Descriptors: reptiles, anatomy, physiology, diseases, excetory apparatus, kidneys, intestines.
Language of Text: Hungarian; Summary in English.

Gal, J., A. Antal, E. Sos, and M. Marosan (2003). **A keteltuek es a hullok legzokeszulekenek anatomiaja, elettana es fontosabb betegsegei. Irodalmi attekintes. [Anatomy, physiology and important diseases of the respiratory apparatus of amphibians and reptiles. Literature review.]**. *Magyar Allatorvosok Lapja* 125(3): 165-171. ISSN: 0025-004X.
Descriptors: amphibians, reptiles, anatomy, physiology , important diseases, respiratory apparatus, literature review.
Language of Text: Hungarian.

Gal, J., E. Sos, L. Mezosi, S. Radvanyi, M. Mandoki, and T. Toth (2006). **Abscess formation caused by *Plesiomonas shigelloides* in the body cavity of the lizard *Ameiva ameiva* (Linnaeus, 1758).** *Salamandra* 42(1): 53-56. ISSN: 0036-3375.
Descriptors: reptiles, lizard, *Amevia amevia*, abcess formation, body cavity, bacteria, *Plesiomonas shigelloides*, chronic inflammation.

Garner, M.M. (2003). **Focus on diseases of reptiles**. *Exotic DVM* 5(3): 65-70. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, lizards, snakes, turtles, diseases, conference proceedings.
Notes: Meeting Information: International Conference on Exotics (ICE2003), Palm Beach, Florida, USA, 2003.

Garner, M.M., S.M. Hernandez Divers, and J.T. Raymond (2004). **Reptile neoplasia: a retrospective study of case submissions to a specialty diagnostic service.** *Veterinary Clinics of North America, Exotic Animal Practice* 7(3): vi, 653-671. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Descriptors: reptiles, neoplasia, retrospective study, case submissions, diagnostic service.

Garner, M.M. and J.T. Raymond (2004). **Methods for diagnosing inclusion body disease in snakes.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 21-25. ISSN: 1529-9651.
Online: http://www.arav.org/
NAL Call Number: SF996.A77
Descriptors: reptiles, inclusion body disease, diagnosing, methods, IBD, snakes, liver biopsy.

Govett, P.D., C.A. Harms, A.J. Johnson, K.S. Latimer, J.F.X. Welleham, M.H. Fatzinger, L.S. Christian, T.R. Kelly, and G.A. Lewbart (2005). **Lymphoid follicular cloacal inflammation associated with a novel herpesvirus in juvenile alligators (*Alligator mississippiensis*).** *Journal of Veterinary Diagnostic Investigation* 17(5): 474-479. ISSN: 1040-6387.
NAL Call Number: SF774.J68
Descriptors: reptiles, juvenile alligators, *Alligator mississippiensis*, lymphoid follicular cloacal inflamation, novel herpesvirus.

Greenblatt, R.J., S.L. Quackenbush, R.N. Casey, J. Rovnak, G.H. Balazs, T.M. Work, J.W. Casey, and C.A. Sutton (2005). **Genomic variation of the fibropapilloma-associated marine turtle herpesvirus across seven geographic areas and three host species.** *Journal of Virology* 79(2): 1125-1132. ISSN: 0022-538X.
NAL Call Number: QR360.J6
Abstract: Fibropapillomatosis (FP) of marine turtles is an emerging neoplastic disease associated with infection by a novel turtle herpesvirus, fibropapilloma-associated turtle herpesvirus (FPTHV). This report presents 23 kb of the genome of an FPTHV infecting a Hawaiian green turtle (*Chelonia mydas*). By sequence homology, the open reading frames in this contig correspond to herpes simplex virus genes UL23 through UL36. The order, orientation, and homology of these putative genes indicate that FPTHV is a member of the Alphaherpesvirinae. The UL27-, UL30-, and UL34-homologous open reading frames from FPTHVs infecting nine FP-affected marine turtles from seven geographic areas and three turtle species (*C. mydas, Caretta caretta*, and *Lepidochelys olivacea*) were compared. A high degree of nucleotide sequence conservation was found among these virus variants. However, geographic variations were also found: the FPTHVs examined here form four groups, corresponding to the Atlantic Ocean, West pacific, mid-Pacific, and east Pacific. Our results indicate that FPTHV was established in marine turtle populations prior to the emergence of FP as it is currently known.
Descriptors: Hawaiian green turtle, (*Chelonia mydas*), herpesvirus, fibropapilloma, genomic variation, neoplastic disease, infection, herpes simplex virus.
Notes: Comment In: J Virol. 2006 May;80(9):4643; author reply 4343-4.

Greenblatt, R.J., T.M. Work, G.H. Balazs, C.A. Sutton, R.N. Casey, and J.W. Casey (2004). **The Ozobranchus leech is a candidate mechanical vector for the fibropapilloma-associated turtle herpesvirus found latently infecting skin tumors on Hawaiian green turtles (*Chelonia mydas*).** *Virology* 321(1): 101-110. ISSN: 0042-6822.
Abstract: Fibropapillomatosis (FP) of marine turtles is a neoplastic disease of ecological

concern. A fibropapilloma-associated turtle herpesvirus (FPTHV) is consistently present, usually at loads exceeding one virus copy per tumor cell. DNA from an array of parasites of green turtles (*Chelonia mydas*) was examined with quantitative PCR (qPCR) to determine whether any carried viral loads are sufficient to implicate them as vectors for FPTHV. Marine leeches (*Ozobranchus* spp.) were found to carry high viral DNA loads; some samples approached 10 million copies per leech. Isopycnic sucrose density gradient/qPCR analysis confirmed that some of these copies were associated with particles of the density of enveloped viruses. The data implicate the marine leech Ozobranchus as a mechanical vector for FPTHV. Quantitative RT-PCR analysis of FPTHV gene expression indicated that most of the FPTHV copies in a fibropapilloma have restricted DNA polymerase expression, suggestive of latent infection.
Descriptors: reptiles, Hawaiian green turtles, *Chelonia mydas*, fibropapilloma, herpesvirus, *Ozobranchus* leech, vector, skin tumor.

Greer, L.L., J.D. Strandberg, and B.R.2. Whitaker (2003). ***Mycobacterium chelonae* osteoarthritis in a Kemp's ridley sea turtle (*Lepidochelys kempii*).** *Journal of Wildlife Diseases* 39(3): 736-741. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Abstract: A stranded Kemp's ridley sea turtle (*Lepidochelys kempii*) was rescued and treated at the National Aquarium in Baltimore (Maryland, USA) for inappetence and epidermal appendicular and plastral lesions. After 4 mo of care, the turtle developed a swollen left elbow joint. Within 1 mo of initial swelling, osteolytic lesions developed in the proximal radius and ulna. The elbow joint was surgically debrided, flushed, and cultured. The incision dehisced 10 days after surgery. *Mycobacterium chelonae* was cultured from the left elbow joint and from a skin nodule of the dorsum of the right front flipper. The turtle was euthanized due to apparent systemic infection with *M. chelonae*. *Mycobacterium chelonae* was isolated from cultures taken at necropsy of the lung, liver, spleen, kidney, and pericardium. Osteoarthritic infections with *M. chelonae* have not been reported in reptiles. Additionally, primary osteoarthritic diseases of synovial joints are uncommon in reptilian species. Due to the paucity of reports of mycobacterial diseases in sea turtles, the continued documentation of these cases will increase knowledge and understanding in caring for these endangered animals.
Descriptors: reptiles, Kemp's ridley sea turtle, *Mycobacterium chelonae*, osteoarthritis, elbow joint, necropsy, liver, spleen, kidney, pericardium, case study.

Greiner, E.C. (2003). **Coccidiosis in reptiles.** *Seminars in Avian and Exotic Pet Medicine* 12(1): 49-56. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: reptiles, coccidiosis, disease, seminar paper.

Guedes, R.M.C. and G.E. Lavalle (2004). **Hepatic cirrhosis in a red-food tortoise (*Geochelone carbonaria*). A case report**. *Arquivo Brasileiro De Medicina Veterinaria e Zootecnia* 56(1): 123-125. ISSN: 0102-0935.
Descriptors: reptiles, red footed tortoise, *Geochelone carbonaria*, hepatic cirrhosis, case

report..
Language of Text: Portuguese.

Hejnar, P., J. Bardon, P. Sauer, and M. Kolar (2007). ***Stenotrophomonas maltophilia* as a part of normal oral bacterial flora in captive snakes and its susceptibility to antibiotics.** *Veterinary Microbiology* 121(3-4): 357-362. ISSN: 0378-1135.
NAL Call Number: SF601.V44
Abstract: Only little is known about normal oral bacterial flora in captive snakes containing *Stenotrophomonas maltophilia*. This microbe has been reported as a causative agent of numerous infections in reptiles. Therefore, the goal of the study was to detect its presence in the mouths of a significant number of healthy captive snakes and determining its susceptibility to antibiotics at 30 and 37 degrees C. The isolates were obtained in 1999-2005 from mouth swabs of 115 snakes of 12 genera and 22 species-most often *Elaphe guttata* (24 individuals; 20.9%). Susceptibility to 24 antibiotics was tested by the microdilution method. The microbe was demonstrated in 34 (29.6%) individuals. Overall, 47 strains of *S. maltophilia* were acquired. Evaluation using PFGE profiles and antibiograms resulted in confirmation of one strain of *S. maltophilia* in 23 (20.0%) individuals, two strains in nine (7.8%) and three in two (1.8%) snakes. All tested antibiotics were more effective at 37 degrees C, with the partial exception of cotrimoxazole and cefoperazone/sulbactam. At a temperature of 37 degrees C, the lowest frequency of resistance to levofloxacin (no resistant strains), cotrimoxazole and ofloxacin (97.9% of susceptible strains) was recorded. At 30 degrees C, the most active agents were cotrimoxazole (97.9% of susceptible strains), levofloxacin (91.5%) and ofloxacin (85.1%). In conclusion, *S. maltophilia* is present in the mouths of about one third of healthy captive snakes, showing good susceptibility to cotrimoxazole, some fluoroquinolones and aminoglycosides. The antibiotics (particularly aminoglycosides) are more effective at 37 degrees C.
Descriptors: reptiles, snakes, oral bacterial flora, captive snakes, *Stenotrophomonas maltophilia*, infection, susceptibility to antibiotics tested.

Helke, K.L., T.K. Cooper, J.L. Mankowski, and S.L. Poynton (2006). **Disseminated visceral coccidiosis in indo-gangetic flap-shelled turtles, *Lissemys punctata andersonii*.** *Journal of Wildlife Diseases* 42(4): 788-796. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: reptiles, flap-shelled turtles, *Lissemys punctata andersonii*, coccidiosis, disseminated visceral, *Eimeria*, lung, liver, auditory canal, pharynx, kidney, spleen.

Herbst, L., A. Ene, M. Su, R. Desalle, and J. Lenz (2004). **Tumor outbreaks in marine turtles are not due to recent herpesvirus mutations.** *Current Biology* 14(17): R697-R699. ISSN: 0960-9822.
Descriptors: reptiles, marine turtles, tumor outbreaks, not due to recent herpesvirus mutations.

Herrera Leon, S., M. Saco, A. Martinez Silvestre , L. Silveira, A. Echeita, and M.A. Usera (2005). **Molecular characterization of a new serovar of *Salmonella bongori* 13,22:z39:- isolated from a lizard.** *Research in Microbiology* 156(4): 597-602. ISSN: 0923-2508.
NAL Call Number: QR1.A55
Abstract: Three Salmonella strains isolated from a lizard (*Gallotia simoni)* in the "Isla del Hierro" (Canary Islands, Spain) were serotyped as *Salmonella bongori* serotype 13,22:z39:-, which has not been described in the Kauffmann-White scheme of Salmonella serovars. In order to shed light on the assignment of those strains to the *S. bongori* species, several genes were amplified and/or sequenced. The iroB gene has been reported to be present only in *S. enterica,* while the invA gene has been described as being a helpful tool in distinguishing Salmonella from other bacterial species. Both genes were amplified and, as expected, only invA could be amplified. The fliC gene, encoding the phase 1 flagellin fljB gene, encoding phase 2 flagellin, and the gapA gene, which is believed to present polymorphic alleles among different subspecies, were amplified and sequenced. The sequence obtained from fliC(z39) matched with the sequences fliC(z39) obtained from other serovars. The sequence obtained from gapA clustered into the *S. bongori* group when it was compared to others previously described. We conclude that these three isolates are members of the *S. bongori* species representing a new serovar that will be described in the next supplement to the Kauffmann-White scheme.
Descriptors: lizards, microbiology, salmonella, genetics, bacterial genetics, proteins genetics, cloning, flagellin genetics, polymerase chain reaction, salmonella classification, Spain.

Hidalgo Vila, J., C. Diaz Paniagua, C. de Frutos Escobar, C. Jimenez Martinez, and N. Perez Santigosa (2007). ***Salmonella* in free living terrestrial and aquatic turtles.** *Veterinary Microbiology* 119(2-4): 311-315. ISSN: 0378-1135.
NAL Call Number: SF601.V44
Abstract: Detection of *Salmonella* in pet turtles has been the focus of extensive research, but its incidence in free living turtles is not well known. The aim of this study was to evaluate the incidence of *Salmonella* in terrestrial and aquatic species of chelonians inhabiting a National Park in southwestern Spain. Individuals of the terrestrial tortoise *Testudo graeca* (n = 16) and the aquatic turtles *Emys orbicularis* (n = 26) and *Mauremys leprosa* (n = 50) were investigated. Maximum incidence of *Salmonella* was recorded in the terrestrial species (100%). In contrast, the incidence of infected animals was low in the aquatic species, 12% in *M. leprosa* and 15.4% in *E. orbicularis*. Five serotypes of *Salmonella* belonging to subspecies *Enterica* (I) and *Salamae* (II) were identified. All serotypes were found in the terrestrial species, and three in the aquatic ones, suggesting that wild terrestrial chelonians are important reservoirs of *Salmonella* in our study area. Cloacal transmission during mating is the most probable mode of transmission among individuals.
Descriptors: reptiles, turtles, aquatic, terrestrial, *Salmonella*, free living, pet turtles, cloacal transmission, incidence.

Hidalgo Vila, J., A. Martainez Silvestre, and C. Daiaz Paniagua (2006). **Benign ovarian teratoma in a red-eared slider turtle (*Trachemys scripta elegans*).** *Veterinary Record* 159(4): 122-123. ISSN: 0042-4900.
NAL Call Number: 41.8 V641

Descriptors: reptiles, red-eared slider turtle, *Trachemys scripta*, ovarian cancer, benign ovarian tumor, case study.

Hong, M.L., L.R. Fu, R.P. Wang, and H.T. Shi (2003). **The advances in the research of the turtle's disease.** *Chinese Journal of Zoology* 38(6): 115-119. ISSN: 0250-3263.
Descriptors: reptiles, turtles, diseases, research, advances, review, cause, diagnosis.
Language of Text: Chinese; Summary in Chinese and English.

Hsieh, C.Y., T.C. Chang, Y.L. Shen, C.D. Chang, C. Tu, M.C. Tung, L.C. Chen, and S.S. Tsai (2006). **Pathological and PCR detection of mycobacteriosis in pond-cultured Chinese soft shell turtles, *Trionyx sinensis*.** *Aquaculture* 261(1): 10-16. ISSN: 0044-8486.
Abstract: Mycobacteriosis due to infection of *Mycobacterium marinum* is a common disease in pond-cultured Chinese soft shell turtles, especially in those surviving beyond their first year. The infected turtles independently showed either heterophilic or histiocytic granulomas in various organs such as the spleen, liver, lungs, intestine, kidneys, stomach and pancreas. The heterophilic granuloma contained many acid-fast unbranching bacilli intracellularly in macrophages and extracellularly in the necrotic center. The histiocytic granuloma had only a few bacteria, mainly in the cytoplasm of Langhan's giant cells. The organisms were rarely observed in the advanced lesions of both types. Based on PCR assays for partial hsp65 gene of Mycobacterium spp., all of our strains were identified as *M. marinum* which can be divided into two groups. The strains of the first group induced heterophilic granulomas and had very high nucleotide sequence identities (99.8%-100%) to the reference strains of *M. marinum* (AF456471) and *M. pseudoshottsii* (AY550226). Those strains of the second group caused histiocytic granulomas and also showed very high identities (99.8%-100%) to the reference strains of *M. marinum* ATCC 927 (AF456470) and *M. shottsii* (AY550225). However, when we compared the partial sequence of the hsp65 gene from group one and two strains the identities between the two groups range from 98.8% to 99.3%, therefore we can not assert that these two belong to the same species.
Descriptors: reptiles, soft shell turtles, *Trionyx sinensis*, *Mycobacterium marinum*, animal pathogenic bacteria, bacterial proteins, sequence analysis, disease detection, pathogen identification, histopathology, turtle culture.

Huchzermeyer, F.W. (2002). **Diseases of farmed crocodiles and ostriches.** *Revue Scientifique Et Technique International Office of Epizootics* 21(2): 265-276. ISSN: 0253-1933.
Abstract: Crocodiles and ostriches are very sensitive to stress, and the ideal conditions for intensive rearing have not yet been established. Consequently, mortality is often directly linked to conditions on the farm. Crocodile and caiman pox, adenoviral hepatitis, mycoplasmosis, chlamydiosis and coccidiosis are crocodile-specific infections with reservoirs in wild populations and adult wild-caught breeding stock. Other important conditions are salmonellosis, non-specific septicaemia, trichinellosis, the nutritional diseases osteomalacia, fat necrosis and gout, as well as winter sores. The only ostrich-specific transmissible disease is libyostrongylosis. Other important conditions are Newcastle disease, avian influenza, fading chick syndrome, tibiotarsal rotation and enteritis. No cases of coccidiosis in ostriches have ever been confirmed.

Descriptors: reptiles, crocodiles, farmed, diseases, stress, intensive rearing, mortality, nutritional diseases.

Irizarry Rovira, A.R., A. Wolf, and J.A. Ramos Vara (2006). **Cutaneous melanophoroma in a green iguana (*Iguana iguana*).** *Veterinary Clinical Pathology* 35(1): 101-105. ISSN: 0275-6382.
NAL Call Number: SF601.A54
Abstract: An adult, male, green iguana (*Iguana iguana*) of unknown age was presented with a history of an enlarging, dark, skin mass in the right axillary region. The mass was excised because neoplasia was suspected. Impression smears of the cut surface of the mass were prepared for cytologic examination, and the mass was fixed for histologic examination. The impression smears contained numerous, discrete, pigmented, neoplastic cells consistent with melanin-producing neoplastic chromatophores. Histologic findings were consistent with a cutaneous melanophoroma. By transmission electron microscopy, the intracytoplasmic pigment granules corresponded to numerous melanosomes and lower numbers of premelanosomes. Tissue sections of the tumor were immunoreactive for Melan A antigen and were negative for S-100 antigen. The cytologic, histologic, electron microscopic, and immunohistochemical findings of the neoplasm were consistent with those of melanophoroma, an uncommon neoplasm of reptiles. The present report augments the limited body of knowledge on cytomorphologic and immunohistochemical characteristics of pigmented neoplasms in reptiles.
Descriptors: green iguana, *Iguana iguana*, skin neoplasms veterinary, skin neoplasms diagnosis, skin neoplasms pathology.

Jacobson, E.R. (2002). **Chlamydiosis: an under reported disease of reptiles.** *Proceedings of the North American Veterinary Conference* 16(16): 916-917. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, diseases, chlamydiosis, under reported, infection.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Jacobson, E.R. (2002). **Infectious diseases of sea turtles.** *Proceedings of the North American Veterinary Conference* 16(16): 912-913. ISSN: 0002-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, turtles, infectious diseases, sea turtles.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Jacobson, E.R., B.L. Homer, B.A. Stacy, E.C. Greiner, N.J. Szabo, C.L. Chrisman, F. Origgi, S. Coberley, A.M. Foley, J.H. Landsberg, L. Flewelling, R.Y. Ewing, R. Moretti, S. Schaf, C. Rose, D.R. Mader, G.R. Harman, C.A. Manire, N.S. Mettee, A.P. Mizisin, and G.D. Shelton (2006). **Neurological disease in wild loggerhead sea turtles *Caretta caretta*.** *Diseases of Aquatic Organisms* 70(1-2): 139-154. ISSN: print: 0177-5103; online: 1616-1580.
Online: http://dx.doi.org/10.3354/dao070139
Abstract: Beginning in October 2000, subadult loggerhead sea turtles *Caretta caretta*

showing clinical signs of a neurological disorder were found in waters off south Florida, USA. Histopathology indicated generalized and neurologic spirorchiidiasis. In loggerhead sea turtles (LST) with neurospirorchiidiasis, adult trematodes were found in the meninges of the brain and spinal cord of 7 and 3 affected turtles respectively, and multiple encephalic intravascular or perivascular eggs were associated with granulomatous or mixed leukocytic inflammation, vasculitis, edema, axonal degeneration and occasional necrosis. Adult spirorchiids were dissected from meningeal vessels of 2 of 11 LST brains and 1 of 10 spinal cords and were identified as *Neospirorchis* sp. Affected LST were evaluated for brevetoxins, ciguatoxins, saxitoxins, domoic acid and palytoxin. While tissues from 7 of 20 LST tested positive for brevetoxins, the levels were not considered to be in a range causing acute toxicosis. No known natural (algal blooms) or anthropogenic (pollutant spills) stressors co-occurred with the turtle mortality. While heavy metal toxicosis and organophosphate toxicosis were also investigated as possible causes, there was no evidence for their involvement. We speculate that the clinical signs and pathologic changes seen in the affected LST resulted from combined heavy spirorchiid parasitism and possible chronic exposure to a novel toxin present in the diet of LST.

Descriptors: subadult loggerhead sea turtles, *Caretta caretta*, nervous system diseases, trematoda infections, turtles, brain parasitology, marine toxins, heavy metals.

Johnson, A.J., A.P. Pessier, and E.R. Jacobson (2007). **Experimental Transmission and Induction of Ranaviral Disease in Western Ornate Box Turtles (*Terrapene ornata ornata*) and Red-Eared Sliders (*Trachemys scripta elegans*).** *Veterinary Pathology* 44(3): 285-297. ISSN: 0300-9858.

Online: http://www.vetpathology.org/cgi/content/abstract/44/3/285

NAL Call Number: 41.8 P27

Abstract: An experimental transmission study was designed to determine whether a causal relationship exists between a Ranavirus (BSTRV) isolated from a Burmese star tortoise that died and the lesions observed in that tortoise. A pilot study was performed with 3 box turtles (*Terrapene ornata ornata*) and 3 red-eared sliders (RESs; *Trachemys scripta elegans*) to assess their suitability in a larger study. Based on the outcome of this study, RESs were selected, and 2 groups of 4 RESs received either an oral (PO) or intramuscular (IM) inoculum containing10(5) 50% Tissue Culture Infecting Dose (TCID(50)) of a BSTRV-infected cell lysate. One turtle each was mock inoculated PO or IM with the same volume of uninfected cell lysate. Three of four IM-inoculated RESs developed clinical signs (nasal and ocular discharge [3 of 3], oral plaques [1 of 3], conjunctivitis and hyphema [1 of 3] and extreme lethargy [3 of 3]). A Ranavirus was isolated from kidney homogenates of 3 euthanatized turtles; DNA sequences of a portion of the major capsid protein gene were amplified by polymerase chain reaction. Consistent histologic lesions were observed only in IM-inoculated turtles and included fibrinoid vasculitis centered on splenic ellipsoids, multifocal hepatic necrosis, and multicentric fibrin thrombi in a variety of locations, including hepatic sinusoids, glomerular capillary loops, and pulmonary capillaries. Virions compatible with Ranavirus were observed within necrotic cells of the spleen of 1 IM-inoculated turtle using transmission electron microscopy. This study fulfills Koch's postulates, confirming a causal relationship between BSTRV and the clinical and histologic changes in chelonians infected with this virus.

Descriptors: reptiles, box turtles, experimental transmission, induction, ranaviral disease, inoculated, PO, IM, clinical signs, Koch's postulates.

Joyner, P.H., J.D. Brown, S. Holladay, and J.M. Sleeman (2006). **Characterization of the bacterial microflora of the tympanic cavity of eastern box turtles with and without aural abscesses**. *Journal of Wildlife Diseases* 42(4): 859-864. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: reptiles, eastern box turtle, aural abscesses, tympanic cavity, bacterial microflora, characterization, aerobic bacterial cultures.

Joyner, P.H., A.A. Shreve, J. Spahr, A.L. Fountain, and J.M. Steeman (2006). **Phaeohyphomycosis in a free-living eastern box turtle (*Terrapene carolina carolina*)**. *Journal of Wildlife Diseases* 42(4): 883-888. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: reptiles, eastern box turtle, free living, phaeohyphomycosis, infection, swelling, hind limb, diagnosis, hematology, necropsy, fungi.

Klenk, K., J. Snow, K. Morgan, R. Bowen, M. Stephens, F. Foster, P. Gordy, S. Beckett, N. Komar, D. Gubler, and M. Bunning (2004). **Alligators as West Nile virus amplifiers.** *Emerging Infectious Diseases* 10(12): 2150-2155. ISSN: print: 1080-6040; online: 1080-6059.
NAL Call Number: RA648.5.E46
Descriptors: reptiles, *Alligator mississippiensis*, West Nile virus, transmission, virus amplifiers, WNV.

Kohler, G. (2006). ***Diseases of Amphibians and Reptiles***, Malabar, USA: Krieger Publishing Company, 171 p. ISBN: 1575242559.
Descriptors: diseases, clinical aspects, diagnosis, euthanasia, examination, neoplasms, imaging techniques, surgery, treatment, amphibians, reptiles, blood tests, first aid, book.

Kuroki, T., Y. Une, and T. Endo (2003). ***Cryptosporidium* infections in reptiles**. *Japanese Journal of Zoo and Wildlife Medicine* 8(1): 27-34. ISSN: 1342-6133.
Descriptors: reptiles, diseases, *Cryptosporidium* infections, Veterinary, feces.
Language of Text: Japanese; Summary in English.

Lane, R.S., J. Mun, L. Eisen, and R.J. Eisen (2006). **Refractoriness of the western fence lizard (*Sceloporus occidentalis*) to the Lyme disease group spirochete *Borrelia bissettii*.** *Journal of Parasitology.* 92(4): 691-696. ISSN: 0022-3395.
Abstract: The western fence lizard, *Sceloporus occidentalis*, is refractory to experimental infection with *Borrelia burgdorferi sensu stricto*, one of several Lyme disease spirochetes pathogenic for humans. Another member of the Lyme disease spirochete complex, *Borrelia bissettii*, is distributed widely throughout North America and a similar, if not identical, spirochete has been implicated as a human pathogen in southern Europe. To determine the susceptibility of *S. occidentalis* to *B. bissettii*, 6 naive lizards were exposed to the feeding activities of *Ixodes pacificus* nymphs experimentally infected with this spirochete. None of the lizards developed spirochetemias detectable by polymerase chain reaction for up to 8 wk post-tick feeding,

infected nymphs apparently lost their *B. bissettii* infections within 1-2 wk after engorgement, and xenodiagnostic *L. pacificus* larvae that co-fed alongside infected nymphs did not acquire and maintain spirochetes. In contrast, 3 of 4 naive deer mice (*Peromyscus maniculatus*) exposed similarly to feeding by 1 or more *B. bissettii*-infected nymphs developed patent infections within 4 wk. These and previous findings suggest that the complement system of *S. occidentalis* typically destroys *B. burgdorferi sensu lato* spirochetes present in tissues of attached and feeding *I. pacificus* nymphs, thereby potentially reducing the probability of transmission of these bacteria to humans or other animals by the resultant adult ticks.
Descriptors: *Borrelia burgdorferi*, immunology, lizards immunology, lizards microbiology, Lyme disease, arachnid vectors, complement system proteins immunology, disease susceptibility, immunity, natural immunology, Ixodes, immunology, transmission.

Lee AnHsing, Chen ChenYu, Lee YinnJie, Fei ChangYung, Liu ChenHsuan, and Chi ChauHwa (2003). **Case report: hepatozoonosis in Taiwan beauty snake**. *Taiwan Veterinary Journal* 29(2): 146-150. ISSN: 1682-6485.
NAL Call Number: SF604.C54
Descriptors: reptiles, Taiwan beauty snake, hepatazoonosis, case reports, diagnosis, haematology, treatment, necropsy.
Language of Text: Chinese; Summary in English.

Lloyd, C., R. Manvell, S. Drury, and A.W. Sainsbury (2005). **Seroprevalence and significance of paramyxovirus titres in a zoological collection of lizards.** *Veterinary Record* 156(18): 578-580. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: lizards, paramyxovirus, titres, antibodies, seroprevalence, zoo, immunosorbent assay, London, respirovirus infections, epidemiology, significance.

Lu, Y.A., Y. Wang, A.A. Aguirre, Z.S. Zhao, C.Y. Liu , V.R. Nerurkar, and R. Yanagihara (2003). **RT-PCR detection of the expression of the polymerase gene of a novel reptilian herpesvirus in tumor tissues of green turtles with fibropapilloma.** *Archives of Virology* 148(6): 1155-1163. ISSN: 0304-8608.
NAL Call Number: 448.3 Ar23
Descriptors: reptiles, green turtles, *Chelonia mydas*, papilloma, animal diseases, gene expression, tissue distribution, Herpesviridae, etiology.

Luechtefeld, L. (2004). **West Nile transmitted from alligator to human**. *Veterinary Practice News* 16(1): 14. ISSN: 1528-6398.
Descriptors: reptiles, alligator, West Nile virus, transmitted to human, virus shedding, feces.

Mader, D.R. and M.M. Garner (2002). **Metabolic bone diseases in the green iguana.** *Proceedings of the North American Veterinary Conference* 16(16): 921-922. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, Iguana, metabolic diseases, bone diseases, veterinary care, diagnosis, meeting.

Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida.

Manire, C.A., H.L. Rhinehart, D.A. Sutton, E.H. Thompson, M.G. Rinaldi, J.D. Buck, and E. Jacobson (2002). **Disseminated mycotic infection caused by *Colletotrichum acutatum* in a Kemp's ridley sea turtle (*Lepidochelys kempi*).** *Journal of Clinical Microbiology* 40(11): 4273-4280. ISSN: 0095-1137.
Online: http://dx.doi.org/10.1128/JCM.40.11.4273-4280.2002
NAL Call Number: QR46.J6
Abstract: *Colletotrichum acutatum* is a cosmopolitan plant pathogen with a wide host range. While the organism's phytopathogenic potential has been well documented, it has never been reported as an etiologic agent of disease in either animals or humans. In this case, a juvenile Kemp's ridley sea turtle, *Lepidochelys kempi,* probably with immune compromise following cold stunning (extended hypothermia), developed a disseminated mycotic infection in the lungs and kidneys. Prophylactic treatment with oral itraconazole did not prevent or cure the infection. This report of a *Colletotrichum acutatum* infection in an animal extends the range of disease caused by this organism beyond that of a phytopathogen.
Descriptors: reptiles, Kemp's ridley sea turtle, *Lepidochelys kempi*, *Colletotrichum* pathogenicity, hypothermia, mycoses, fatal outcome, mycotic infection, plant diseases.

Marschang, R.E., S. Donahoe, R. Manvell, and J. Lemos Espinal (2002). **Paramyxovirus and reovirus infections in wild-caught Mexican lizards (*Xenosaurus* and *Abronia* spp.).** *Journal of Zoo and Wildlife Medicine* 33(4): 317-321. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Abstract: Virus isolation attempts were carried out on wild-caught *Xenosaurus grandis, X. platyceps*, and *Abronia graminea* from Mexico. These animals were also tested for exposure to paramyxoviruses and reoviruses. Pharyngeal and cloacal swabs were collected from 30 lizards, and blood was collected from 23 lizards. A cytopathogenic virus was isolated from the cloacal swab of one of the *X. platyceps*. The isolate was identified as a paramyxovirus on the basis of its sensitivity to chloroform, resistance to 5-iodo-2'-deoxyuridine, size and morphology of the viral particles, hemagglutination of chicken erythrocytes, and serologic reaction with paramyxovirus-specific antisera. Antibodies against the paramyxovirus isolated in this study were found in four animals from three species. Antibodies against a different paramyxovirus isolated from a monitor lizard were found in seven animals from three species, showing that all the species tested are susceptible to paramyxovirus infections. Antibodies to a reptilian reovirus were found in three of the *X. grandis*.
Descriptors: reptiles, wild caught Mexican lizards, *Xenosaurus*, *Abronia*, paramyxovirus, reovirus, blood, pharyngeal, cloacal, swabs.

Maslow, J.N., R. Wallace, M. Michaels, H. Foskett, E.A. Maslow, and J.A. Kiehlbauch (2002). **Outbreak of *Mycobacterium marinum* infection among captive snakes and bullfrogs.** *Zoo Biology* 21(3): 233-241. ISSN: 0733-3188.
NAL Call Number: QL77.5.Z6
Descriptors: reptiles, snakes, zoo animals, zoos, bullfrogs, *Rana catesbeiana*, mycobacterial

diseases, *Mycobacterium marinum*, strain differences, mortality, disease transmission, Wisconsin, aquatic animals, outbreaks, disease surveys.

McCowan, C., C. Shepherdley, and R.F. Slocombe (2004). **Herpesvirus-like particles in the skin of a saltwater crocodile (*Crocodylus porosus*). [Erratum: 2004 Sept., v. 82, no. 9, p. 579.].** *Australian Veterinary Journal* 82(6): 375-377. ISSN: 0005-0423.
NAL Call Number: 41.8 Au72
Descriptors: reptiles, saltwater crocodile, herpesevirus like particles, skin.

Meier, J., D. Jarofke, and M. Vix (2004). **Viruses in turtles (Reptilia: Chelonia): a review.** *Zoologische Garten* 74(6): 371-378. ISSN: 0044-5169.
Descriptors: reptiles, turtles, viruses, review, Chelonia, diseases.
Language of Text: English; German.

Mohan, K., F. Dziva, N.L. Mukarati, and D. Moyo (2005). **Possible new *Chlamydophila* species causing chlamydiosis in farmed Nile crocodiles (*Crocodylus niloticus*).** *Veterinary Record* 157(1): 23-25. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: crocodiles, *Crocodylus niloticus*, *Chlamydophila*, isolation, purification, chlamydophila infections, pathogenicity, pathology, liver pathology, RNA, swine, Zimbabwe.

Nagano, N., S. Oana, Y. Nagano, and Y. Arakawa (2006). **A severe *Salmonella enterica* serotype Paratyphi B infection in a child related to a pet turtle, *Trachemys scripta elegans*.** *Japanese Journal of Infectious Diseases* 59(2): 132-134. ISSN: 1344-6304.
Abstract: Our report highlights a case of severe childhood salmonellosis related to a pet turtle, a red-eared slider (*Trachemys scripta elegans*). A 6-year-old girl had gastroenteritis complicated with sepsis caused by serotype Paratyphi B, which shared the same pulsed-field gel electrophoresis profiles with the organism isolated from a pet turtle. Based on our literature survey on childhood invasive salmonellosis acquired from reptiles, this case is the first documented reptile-associated salmonellosis including sepsis caused by this serotype.
Descriptors: reptiles, child infected by *Salmonella enterica*, Paratyphi B, pet turtle, *Trachemys scripta elegans*, gastroenteritis, salmonellosis.

Nakadai, A., T. Kuroki, Y. Kato, R. Suzuki, S. Yamai , C. Yaginuma, R. Shiotani, A. Yamanouchi, and H. Hayashidani (2005). **Prevalence of *Salmonella* spp. in pet reptiles in Japan.** *Journal of Veterinary Medical Science* 67(1): 97-101. ISSN: print: 0916-7250; online: 1347-7439.
Online: http://dx.doi.org/10.1292/jvms.67.97
NAL Call Number: SF604.J342
Abstract: From November 2000 to July 2002, 112 fecal samples from pet reptiles, including 18 turtles, 71 lizards and 23 snakes, sold at a pet shop were examined for the prevalence of *Salmonella* spp. in Japan. *Salmonella* spp. were isolated from 83 (74.1%) of 112 samples, and a total of 112 *Salmonella* isolates were identified as subspecies I to IV. The majority of isolates (62.5%) belonged to subspecies I and 54 isolates could be identified as any of 28 serovars. The predominant serovars were found to be *S. Bardo*, *S. Newport* and *S. Panama*, which cause

human salmonellosis. These results indicate that pet reptiles may be a potential infectious source of human salmonellosis in Japan.
Descriptors: pet reptiles, *Salmonella*, prevalence, Japan, fecal samples, lizards, turtles, snakes, pet shop, human infection.

Nevarez, J.G., M.A. Mitchell, Dae Young Kim, R. Poston, and H.M. Lampinen (2005). **West Nile virus in alligator, *Alligator mississippiensis*, ranches from Louisiana.** *Journal of Herpetological Medicine and Surgery* 15(3): 4-9. ISSN: 1529-9651.
NAL Call Number: SF997.5.R4 B85
Descriptors: reptiles, alligator, *Alligator mississippiensis*, West Nile virus, ranches, diseases, Louisiana, USA.

Oprescu, I. (2004). **Bolile parazitare ale reptilelor si terapia lor. (Partea A II-A). [The parasitic diseases of reptiles and their treatment. (Part II)].** *Revista Romana De Medicina Veterinara* 14(1): 67-74. ISSN: 1220-3173.
Descriptors: reptiles, parasitic diseases, treatment, veterinary.
Language of Text: Romanian.

Oros, J., B. Acosta, J.M. Gaskin, S. Deniz, and H.E. Jensen (2003). ***Mycobacterium kansasii* infection in a Chinese soft shell turtle (*Pelodiscus sinensis*).** *Veterinary Record* 152(15): 474-476. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, soft shell turtle, *Pelodiscus sinensis*, *Mycobacterium kansasii*, bacterial infection, disease, case report.

Oros, J., A. Arencibia, L. Fernandez, and H.E. Jensen (2004). **Intestinal candidiasis in a loggerhead sea turtle (*Caretta caretta*): An immunohistochemical study.** *The Veterinary Journal* 167(2): 202-207. ISSN: 1090-0233.
NAL Call Number: SF601.V484
Abstract: Post mortem examination of a juvenile loggerhead sea turtle (*Caretta caretta*) stranded in the Canary Islands revealed a fishing-line in the small intestine. Histologically, severe necrotic enteritis, multiple haemorrhages, and marked oedema of the intestinal submucosa were observed. Yeast cells and fungal hyphae were seen in the lamina propria of the intestinal mucosa and in the connective tissue of the submucosa. Because fungal cultures were not taken at the time of necropsy, an immunohistochemical study was performed in order to identify the fungus involved. Specific monoclonal and heterologously absorbed polyclonal antibodies served as the primary reagents for identification of aspergillosis, candidiasis, fusariosis, geotricosis, scedosporiosis, and zygomycosis, using an indirect immunofluorescence staining technique. The fungal elements were strongly stained only by a polyclonal antibody against *Candida albicans* and a monoclonal antibody against *C. albicans*. There are no known previous reports of Candida sp. causing skin disease or systemic mycotic infection in sea turtles.
Descriptors: reptiles, loggerhead sea turtle, *Caretta caretta*, intestinal candidiasis, necrotic enteritis, yeast cells, fungal hyphae, lamina propria, case report, Canary Islands, stranding.

Oros, J., C. Delgado, L. Fernandez, and H.E. Jensen (2004). **Pulmonary hyalohyphomycosis caused by *Fusarium* spp. in a Kemp's ridley sea turtle (*Lepidochelys kempi*): An immunohistochemical study**. *New Zealand Veterinary Journal* 52(3): 150-152. ISSN: 0048-0169.
NAL Call Number: 41.8 N483
Descriptors: reptiles, Kemp's ridley sea turtle, *Lepidochelys kempi*, pulmonary hyalohypomycosis, *Fusarium* specis, immunohistochemical study.

Oros, J., A. Torrent, P. Calabuig, and S. Deniz (2005). **Diseases and causes of mortality among sea turtles stranded in the Canary Islands, Spain (1998-2001).** *Diseases of Aquatic Organisms* 63(1): 13-24. ISSN: print: 0177-5103; online: 1616-1586.
Online: http://dx.doi.org/10.3354/dao063003
Abstract: This paper lists the pathological findings and causes of mortality of 93 sea turtles (88 *Caretta caretta*, 3 *Chelonia mydas*, and 2 *Dermochelys coriacea*) stranded on the coasts of the Canary Islands between January 1998 and December 2001. Of these, 25 (26.88%) had died of spontaneous diseases including different types of pneumonia, hepatitis, meningitis, septicemic processes and neoplasm. However, 65 turtles (69.89%) had died from lesions associated with human activities such as boat-strike injuries (23.66%), entanglement in derelict fishing nets (24.73%), ingestion of hooks and monofilament lines (19.35%), and crude oil ingestion (2.15%). Traumatic ulcerative skin lesions were the most common gross lesions, occurring in 39.78% of turtles examined, and being associated with *Aeromonas hydrophila*, *Vibrio alginolyticus* and *Staphylococcus* spp. infections. Pulmonary edema (15.05%), granulomatous pneumonia (12.90%) and exudative bronchopneumonia (7.53%) were the most frequently detected respiratory lesions. Different histological types of nephritis included chronic interstitial nephritis, granulomatous nephritis and perinephric abscesses, affecting 13 turtles (13.98%). Ulcerative and fibrinous esophagitis and traumatic esophageal perforation were the most frequently observed lesions in the esophagus, being associated in the majority of the cases with ingestion of fishing hooks. Larval nematodes of the Anisakidae family caused gastritis in 15 turtles (16.13%). Necrotizing and/or granulomatous hepatitis were the lesions most commonly observed in the liver (27.95%). Traumatic lesions included necrotizing myositis (10.75%) mainly caused by entanglement in fishing nets or boat-strikes, and amputation of 1 or 2 flippers (25.81%) by netting. Traumatic erosions and/or fractures of the carapace/plastron mainly caused by boat-strikes were also observed (26.88%). Eye lesions included heterophilic keratoconjunctivitis, ulcerative keratitis and heterophilic scleritis, affecting 7 turtles (7.53%).
Descriptors: sea turtles microbiology, parasitology, physiology, diseases, epidemiology, disease mortality, pathology, cause of death, turtles anatomy, histology, Canary Islands.

Oros, J., S. Tucker, L. Fernandez, and E.R. Jacobson (2004). **Metastatic squamous cell carcinoma in two loggerhead sea turtles *Caretta caretta*.** *Diseases of Aquatic Organisms* 58(2-3): 245-250. ISSN: print: 0177-5103; online: 1616-1586.
Online: http://dx.doi.org/10.3354/dao058245
Abstract: We received 2 stranded loggerhead sea turtles (*Caretta caretta*) with squamous cell carcinomas to necropsy. The dead turtles had been collected in Gran Canaria and Fuerteventura in April 1994 and May 1997, respectively to determine the cause of death. One

turtle had 3 ulcerated lesions in the dorsal part of the neck and several irregular masses in the lungs and kidneys. Histologic examination of lesions in the skin, lungs, kidneys, and ventricular myocardium revealed neoplastic proliferation of abnormal keratinocytes. Ultrastructural examination identified the tumoral cells as epithelial cells. The second turtle had 4 lesions in the skin of the head and flippers, and several irregular masses in the lungs, liver, and kidneys. Histological examination revealed a squamous cell carcinoma with metastases to muscle tissue, liver, lungs, and kidneys. Attempts to characterize the tumoral cells by immunohistochemistry using several monoclonal and polyclonal antisera against high and low molecular weight cytokeratins from mammals, as well as vimentin and desmin, failed. Differences between reptilian keratins (mainly beta-keratins) and mammalian keratins (mainly alpha-keratins) could explain this absence of immunoreactivity. This is the first description of squamous cell carcinoma in sea turtles.
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, squamous cell carcinioma, necropsy, muscle tissue, lungs, liver, kidneys.

Otokunefor, T.V., B.I. Kindzeka, I.O. Ibiteye, G.U. Osuji, F.O. Obi, and A.W.K. Jack (2003). **Salmonella in gut and droppings of three pest lizards in Nigeria.** *World Journal of Microbiology and Biotechnology* 19(5): 545-548. ISSN: 0959-3993.
NAL Call Number: QR1.M562
Descriptors: reptiles, *Gekkonidae* sp., *Lacertilia*, lizards, disease vectors, household pests, feces, intestinal microorganisms, food pathogens, animal pathogens, *Salmonella*, *Agama agama*, *Ameiva ameiva.*, Nigeria.

Otto Boede, E. and O. Hernandez (2004). **Enfermedades en tortugas Arrau o del Orinoco, *Podocnemis expansa*, mantenidas en zoocriaderos Venezolanos. [Diseases in Arrau sideneck turtle, *Podocnemis expansa*, kept in Venezuelan farms].** *Revista Cientifica* 14(5): 395-403. ISSN: 0798-2259.
Descriptors: reptiles, diseases, Arrau sideneck turtle, *Podocnemis expansa*, farms, Venezuela.
Language of Text: Spanish; Summary in English.

Pasmans, F., P.d. Herdt, J. Dewulf, and F. Haesebrouck (2002). **Pathogenesis of infections with *Salmonella enterica* subsp. *enterica serovar Muenchen* in the turtle *Trachemys scripta scripta*.** *Veterinary Microbiology* 87(4): 315-325. ISSN: 0378-1135.
NAL Call Number: SF601.V44
Abstract: The pathogenesis of *Salmonella enterica* subsp. *enterica serovar Muenchen* infections in the aquatic turtle *Trachemys scripta scripta* was studied. After oral infection with 5 x 10(5) cfu of serovar Muenchen of 10-14-month-old turtles, kept at 26 degrees C, the intestine and especially the ileum, caecum and colon was colonized. Invasion of the intestinal wall, causing histopathological lesions, and colonization of internal organs were not observed. Serovar Muenchen was only isolated from turtles for 8 days after exposure. Keeping the turtles at 37 degrees C caused colonization of liver and spleen in two of six orally infected turtles and augmented the numbers of bacteria in the intestinal tract. In contrast to oral infections, intraperitoneal infections of turtles with serovar Muenchen enabled the bacterium to persist inside the host for at least 5 weeks. Clearance of serovar Muenchen from the liver and

blood was more pronounced at 26 degrees C than at 37 degrees C. ELISA antibodies were demonstrated in intraperitoneally but not in orally infected turtles kept at 26 degrees C. In conclusion, the lack of persistence and invasiveness of serovar Muenchen in *T. s. scripta* after oral exposure might be due to the turtle's relatively low body temperature and/or the absence of well-organized gut-associated lymphoid tissue.
Descriptors: reptiles, Cheloniidae, *Salmonella* , genetic variation, pathogenesis, disease course, intestines, ileum, cecum, colon, infection, histopathology, shedding, persistence.

Pasmans, F., P.d. Herdt, and F. Haesebrouck (2002). **Presence of *Salmonella* infections in freshwater turtles.** *Veterinary Record* 150(22): 692-693. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, turtles, Testudines, *Salmonella*, salmonellosis, disease prevalence, disease transmission, risk.

Pasmans, F., A. Martel, F. Boyen, D. Vandekerchove, I. Wybo, F.V. Immerseel, M. Heyndrickx, J.M. Collard, R. Ducatelle, and F. Haesebrouck (2005). **Characterization of *Salmonella* isolates from captive lizards.** *Veterinary Microbiology* 110(3-4): 285-291. ISSN: 0378-1135.
NAL Call Number: SF601.V44
Abstract: Reptile-associated salmonellosis in humans is an increasing public health issue. This study aimed at characterizing *Salmonella* isolates from captive lizards and to compare them to human isolates. *Salmonella* was isolated from 25 of 33 cloacal and 47 of 79 faecal samples from captive lizards (75.8 and 59.5%, respectively). The strains belonged to 44 serotypes of subspecies I (27 serotypes), II (9), IIIb (3) and IV (5). Two strains, one of serotype Enteritidis and one of serotype Amsterdam, were resistant to nitrofurantoin. Invasion assays in Caco-2 cells were performed with 40 saurian isolates of subspecies I, 15 isolates of subspecies II, 4 strains of subspecies IIIb, 6 subspecies IV isolates and 17 human isolates of corresponding serotypes of subspecies I. Saurian isolates belonging to subspecies I invaded the Caco-2 cells to a higher extent than those from the other subspecies. The human isolates invaded the Caco-2 cells to a lesser degree compared to their saurian counterparts. In the same strains, the presence of virulence genes agfA, shdA, spvR, pefA and sopE was determined using PCR. Whereas agfA was detected in all strains, pefA was only detected in one saurian and in the human serotype Enteritidis strains. The spvR gene was detected in the same serotype Enteritidis strains and in 33% of the subspecies IV strains. The shdA gene was present in all the human isolates and in 86% of subspecies I saurian isolates. SopE was found in 17% of the human isolates, in 24% of the saurian subspecies I strains and in all of the subspecies IV strains.
Descriptors: captive lizards, *Salmonella* isolates, characterization, strain, *Salmonella* infections, pathogenicity, infections, serotyping, humans, virulence.

Pasmans, F., F. Van Immerseel, W. Van den Broeck , E. Bottreau, P. Velge, R. Ducatelle, and F. Haesebrouck (2003). **Interactions of *Salmonella enterica subsp. enterica serovar Muenchen* with intestinal explants of the turtle *Trachemys scripta scripta.*** *Journal of Comparative Pathology* 128(2-3): 119-126. ISSN: 0021-9975.
Abstract: *Salmonella* infections in reptiles, in contrast to those in birds and mammals, are

limited to the intestinal tract. In this study, interactions of a strain of *Salmonella enterica subsp. enterica serovar Muenchen* (SEEM) with intestinal explants of the turtle *Trachemys scripta scripta* were examined by scanning electron microscopy (SEM). Adhesion and invasion in the chelonian intestinal explants at 30 degrees C and 37 degrees C were evaluated quantitatively. For purposes of comparison, the invasive capacity of SEEM in the continuous avian epithelial cell line DIV-1 at 30 degrees C and 37 degrees C was determined. Small numbers of M-like cells were found in the ileum of the turtles. The bacteria adhered mainly to the mucus of the intestinal explants. Only small numbers of salmonellae were associated with epithelial cells. Higher numbers of bacteria adhered at 30 degrees C than at 37 degrees C. Epithelial damage, embedding of bacteria in the epithelial surface and a ruffling-like process were noted only at 37 degrees C. Minimal numbers of salmonellae invaded the explants at 30 degrees C and 37 degrees C. Invasion of DIV-1 cells was greater at 37 degrees C than at 30 degrees C. The study suggested that the intestinal mucous layer provides an important site of colonization for salmonellae in the chelonian host and protects the underlying epithelial cells.
Descriptors: reptiles, turtle, *Salmonella* infections, intestinal explants, intestinal mucous layer, colonization.

Petterino, C., M. Bedin, G. Podesta, and A. Ratto (2006). **Undifferentiated tumor in the ovary of a corn snake (*Elaphe guttata guttata*).** *Veterinary Clinical Pathology* 35(1): 95-100. ISSN: 0275-6382.
NAL Call Number: SF601.A54
Abstract: A 6-year-old intact female corn snake (*Elaphe guttata guttata*) was presented with a 3-week history of anorexia. Coelomic radiographs revealed a 9 x 4 cm soft tissue opacity suggestive of a right ovarian enlargement. The mass (9 x 5 x 4 cm) was surgically removed, and multiple smears from tissue sections were stained with Diff-Quik. Multiple tissue samples from the mass were collected and fixed in formalin. Cytologic specimens were moderately cellular and contained light pink amorphous background material. The cells were primarily spindle-shaped with moderate to marked anisocytosis and anisokaryosis. Cells sometimes were round to polygonal, and rarely were arranged in small clusters. Macrophages occasionally were observed. Histologic specimens consisted of a highly cellular mass composed of pleomorphic, spindle-shaped cells and, occasionally, round to polygonal cells arranged in irregular fascicles. The neoplastic cells were immunoreactive for cytokeratin (AE1/AE3), smooth muscle actin, and skeletal muscle actin, but did not stain for vimentin or desmin. On the basis of the morphologic and immunohistochemical results, a diagnosis of ovarian undifferentiated carcinoma was made. In this report, we describe the challenges of using immunohistochemistry to diagnose this uncommon type of tumor in reptiles.
Descriptors: reptiles, corn snake, ovary, undifferentiated tumor, anorexia, ovarian enlargement, coelomic radiographs, tumor, carcinoma.

Pfleger, S., G. Benyr, R. Sommer, and A. Hassl (2003). **Pattern of *Salmonella* excretion in amphibians and reptiles in a vivarium.** *International Journal of Hygiene and Environmental Health* 206(1): 53-59. ISSN: 1438-4639.
Online: http://www.sciencedirect.com/science/journal/14384639
Abstract: During a period of about three years the faeces of five species of amphibians (35

individuals) and of 23 species of reptiles (103 individuals) living in one vivarium with terrariums imitating different types of ecosystems were examined for *Salmonellae*. From 54 out of 376 faecal samples Salmonella spp. was isolated (= 14%). Twenty-one different *Salmonella* strains were found. *Salmonellae* could be isolated about twice as often from animals kept under arid or mesic conditions than from animals living in humid or aquatic environments although this was not statistically significant. Statistically significant for the rate of *Salmonella* excretion was the animals' diet and the class the animals are belonging to. Animals feeding on mice (p = 0.04) and reptiles in general (p = 0.04) were more commonly excreting *Salmonella*. Duration of stay was also a significant factor (p = 0.0005), whereby the relative risk for *Salmonella* excretion increased with the factor 2.91 per year during the investigation period. *Salmonella* strains were not necessarily transferred among animals living in the same terrarium or among the inhabitants of different terrariums. The pattern of *Salmonella* excretion was generally fragmentary. The outsides as well as the insides of the walls of the terrariums were also tested for salmonellae several times, but Salmonellae have never been isolated.
Descriptors: amphibians, reptiles, *Salmonella*, excretion, pattern, vivarium, terrariums, ecosystems, fecal samples.

Phillott, A.D., C.J. Parmenter, and S.C. McKillup (2006). **Calcium depletion of eggshell after fungal invasion of sea turtle eggs.** *Chelonian Conservation and Biology* 5(1): 146-149. ISSN: 1071-8443.
Descriptors: reptiles, sea turtle, *Caretta caretta*, depletion of eggshell, calcium depletion, fungal invasion, *Natator depressus*, *Eretmochelys imbricata*, *Chelonia mydas*, *Fusarium solani.*

Pospischil, A.S. (2003). **Novel chlamydiae in cats and reptiles.** *Abstracts of the General Meeting of the American Society for Microbiology* 103: Z-023. ISSN: 1060-2011.
Online: http://www.asmusa.org/mtgsrc/generalmeeting.htm
Descriptors: reptiles, chlamydia infection, cats, PCR assay, meeting abstracts.
Notes: Meeting Information: 103rd American Society for Microbiology General Meeting, Washington, DC, USA; May 18-22, 2003.

Reavill, D.R., M. Melloy, and R.E. Schmidt (2004). **Reptile mycotic infections from the literature and 55 cases.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 62-71. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: reptiles, Chelonia, Sauria, Serpentes, mycotic infections, fungal diseases, mycosis, infections, literature review.

Reisen, W.K., A.C. Brault, V.M. Martinez, Y. Fang, K. Simmons, S. Garcia, E. Omi Olsen, and R.S. Lane (2007). **Ability of transstadially infected *Ixodes pacificus* (Acari: Ixodidae) to transmit West Nile virus to song sparrows or western fence lizards.** *Journal of Medical Entomology* 44(2): 320-327. ISSN: 0022-2585.
NAL Call Number: 421 J828
Abstract: The hypothesis that *Ixodes pacificus* Cooley & Kohls (Acari: Ixodidae) may serve as a reservoir and vector of West Nile virus (family Flaviviridae, genus Flavivirus, WNV) in

California was tested by determining the ability of this tick species to become infected with the NY99 strain of WNV while feeding on viremic song sparrows, to maintain the infection transstadially, and then to transmit WNV to recipient naive song sparrows and western fence lizards during the nymphal stage. The percentage of ticks testing positive by reverse transcription-polymerase chain reaction (RT-PCR) decreased from 77% of 35 larvae at day 6 after ticks were transferred to donor song sparrows (day of detachment) to 23% of 35 nymphs at 59 d postinfestation (approximately 19 d after molting to the nymphal stage). However, the percentage of ticks positive by RT-PCR from which infectious virus was recovered by Vero cell assay decreased from 59% on day 6 to 12% on day 59, even though there was no statistically significant decrease in the quantity of RNA within positive ticks. Attempts to improve the sensitivity of plaque assays by blind passage through C6/36 cell cultures were unsuccessful. These data indicated that ticks maintained viral RNA but not necessarily infectious virus over time. Nymphs from larvae that fed on song sparrows with peak viremias ranging from 7.2 to 8.5 log10 plaque-forming units (PFU) per ml were used in transmission attempts. From one to seven RNA-positive nymphal ticks engorged and detached from each of four recipient song sparrows or western fence lizards. Blood samples from sparrows and lizards remained negative, indicating that transmission did not occur. An additional four lizards inoculated with 1,500 PFU of WNV developed moderate viremias, ranging from 4.2 to 5.6 log10 PFU/ml. Our data and data from previous studies collectively indicated that ixodid ticks were not able to experimentally transmit WNV and therefore most likely would not be important vectors in WNV transmission cycles.

Descriptors: reptiles, ticks, *Ixodes pacificus*, West Nile virus, sparrows, western fence lizards, disease reservoir, vector, virus transmission.

Richter, D. and F.R. Matuschka (2006). **Perpetuation of the Lyme disease spirochete *Borrelia lusitaniae* by lizards.** *Applied and Environmental Microbiology* 72(7): 4627-4632. ISSN: 0099-2240.

Online: http://dx.doi.org/10.1128/AEM.00285-06

NAL Call Number: 448.3 Ap5

Abstract: To determine whether the Lyme disease spirochete *Borrelia lusitaniae* is associated with lizards, we compared the prevalence and genospecies of spirochetes present in rodent- and lizard-associated ticks at a site where this spirochete frequently infects questing ticks. Whereas questing nymphal *Ixodes ricinus* ticks were infected mainly by *Borrelia afzelii*, one-half of the infected adult ticks harbored *B. lusitaniae* at our study site. Lyme disease spirochetes were more prevalent in sand lizards (*Lacerta agilis*) and common wall lizards (*Podarcis muralis*) than in small rodents. Although subadult ticks feeding on rodents acquired mainly *B. afzelii*, subadult ticks feeding on lizards became infected by *B. lusitaniae*. Genetic analysis confirmed that the spirochetes isolated from ticks feeding on lizards are members of the *B. lusitaniae* genospecies and resemble type strain PotiB2. At our central European study site, lizards, which were previously considered zooprophylactic for the agent of Lyme disease, appear to perpetuate *B. lusitaniae*.

Descriptors: reptiles, lizards, Lyme disease, *Borrelia lusitaniae*, perpetuation, spirochete, rodent, prevalence, ticks.

Rosenthal, K. (2004). **A new look at treatment of calcium: Phosphorus disorders in iguanas**. *Proceedings of the North American Veterinary Conference* 18: 1348. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, iguanas, calcium-phosphorus disorders.
Notes: In the volume: Small Animal and Exotics. Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Saelinger, C.A., G.A. Lewbart, L.S. Christian, and C.L. Lemons (2006). **Prevalence of *Salmonella* spp in cloacal, fecal, and gastrointestinal mucosal samples from wild North American turtles.** *Journal of the American Veterinary Medical Association* 229(2): 266-268. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Abstract: OBJECTIVE: To determine prevalence of *Salmonella* spp in samples collected from wild North American turtles. ANIMALS: 94 wild North American turtles of 6 species in 2 genera. DESIGN: Prospective microbiologic study. PROCEDURES: A convenience sample of wild North Carolina turtles admitted to a veterinary college was evaluated for Salmonella spp by use of standard techniques via microbiologic culture of cloacal swab and fecal samples. Gastrointestinal mucosa samples were also collected at necropsy from turtles that died or were euthanized. Cloacal swab samples were also collected from wild pond turtles for bacteriologic culture. Controls were established by use of wild-type *Salmonella Typhimurium* LT2. RESULTS: 94 turtles were tested for *Salmonella* spp; *Salmonella* spp were not detected in any sample. By use of a pathogen-prevalence and sample-size table, the true prevalence of *Salmonella* spp was estimated as < 5%. CONCLUSIONS AND CLINICAL RELEVANCE: Results suggested that wild turtles in central North Carolina may not be active shedders or carriers of *Salmonella* spp. Despite this 0% prevalence of infection, proper hygiene practices should be followed when handling wild turtles.
Descriptors: cloaca microbiology, feces, intestinal mucosa, *Salmonella* infections, turtles microbiology, disease reservoirs, prevalence.

Sand, M.A., K.S. Latimer, C.R. Gregory, P.M. Rakich, E. Jacobson, and K.E. Pennick (2004). **Molecular diagnosis of paramyxovirus infection in snakes using reverse transcriptase-polymerase chain reaction and complementary deoxyribonucleic acid:ribonucleic acid in situ hybridization.** *Journal of Veterinary Diagnostic Investigation* 16(5): 442-448. ISSN: 1040-6387.
NAL Call Number: SF774.J68
Descriptors: reptiles, snakes, paramyxovirus, infection, molecular diagnosis, reverse transcript polymerase chain reaction, complementary deoxyribonucleic acidribonucleic acid , in situ, hybridization.

Schroter, M., P. Roggentin, J. Hofmann, A. Speicher, R. Laufs, and D. Mack (2004). **Pet snakes as a reservoir for *Salmonella enterica* subsp. *diarizonae* (serogroup IIIb): A prospective study.** *Applied and Environmental Microbiology* 70(1): 613-615. ISSN: 0099-2240.
Online: http://dx.doi.org/10.1128/AEM.70.1.613-615.2004
NAL Call Number: 448.3 Ap5

Abstract: Reptile-associated *Salmonella* infections are an increasing problem for humans. We have prospectively screened two breeding groups of 16 pet snakes for colonization with *Salmonella* species. Various serovars of *S. enterica* subsp. *diarizonae* were found in 81% of the snakes. To avoid transmission, strict hygienic precautions should be applied when reptiles are handled.

Descriptors: reptiles, *Salmonella enterica* subsp. *diarizonae*, animal pathogenic bacteria, serotypes, isolation, feces, snakes, pets, Viperidae, disease reservoirs, salmonellosis, zoonoses, *Bitis nasicornis*, *Bothriechis schlegelii.*

Schroter, M., A. Speicher, J. Hofmann, and P. Roggentin (2006). **Analysis of the transmission of *Salmonella* spp. through generations of pet snakes.** *Environmental Microbiology* 8(3): 556-559. ISSN: print: 1462-2912; online: 1462-2920.

Abstract: Besides the 'classical' animals known as reservoirs for *Salmonella* spp., like poultry and cattle, reptiles have emerged as a significant source of human Salmonellae infections during the last years. Reptile-associated Salmonellae frequently cause severe clinical courses including fatalities due to septicaemia and meningitis. Therefore, it is of major priority to develop measures which may help preventing cases of reptile-associated Salmonellae. However, as a first step the epidemiology of salmonellae in reptiles must be understood. Therefore, in this study a population analysis of the salmonellae of two female snakes was performed and the pattern of inheritance of Salmonellae to their offspring was investigated. It is demonstrated that adult snakes usually harbour a population of concurrent Salmonellae serovars. Colonization of their offspring during pregnancy and birth is a significant way of transmission causing 65% of the newborn to be positive for Salmonellae. The effectiveness of the transmission does not seem to be due only to the frequency of a certain serovar, because the most prevailing strain of one female snake was not detectable in any of her offspring.

Descriptors: *Salmonella* isolation and purification, *Salmonella* infections, animal transmission, snakes microbiology, bacterial typing techniques, disease transmission, vertical veterinary, *Salmonella* classification, serotyping.

Schumacher, J. (2003). **Fungal diseases of reptiles.** *Veterinary Clinics of North America, Exotic Animal Practice* 6(2): 327-335. ISSN: 1094-9194.

NAL Call Number: SF997.5.E95 E97

Abstract: Fungal infections affecting the integumentary system, the upper and lower respiratory system and the gastro-intestinal tract have been reported in many species of captive reptiles. Systemic mycoses are diagnosed rarely in reptiles, and in most cases, they are a postmortem finding. Commonly, immunocompromised reptiles, kept in suboptimal environmental conditions are affected. In many cases, mixed bacterial and fungal infections of opportunistic organisms may be present. A diagnosis of a primary fungal infection is based on proper selection and collection of diagnostic specimens such as biopsies of infected tissues. Treatment of fungal infections in reptiles includes administration of effective antifungal agents and correction of inappropriate environmental conditions such as poor hygiene, too high or too low temperature and humidity, inadequate diet, and stress from overcrowding. Few studies have investigated effective dosages and dosage intervals of antifungal agents in reptiles.

Descriptors: reptiles, fungal diseases, infections, respiratory, upper, lower, mycosis, systemic, gastrointestinal tract, diagnosis.

Selleri, P. and S.J. Hernandez Divers (2006). **Renal diseases of reptiles.** *Veterinary Clinics of North America, Exotic Animal Practice* 9(1): 161-174. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Renal disease is one of the most common problems in reptilian medicine. Herbivorous species seem to be more susceptible than carnivores. The causation may be multifactorial, and the signs are often nonspecific. Prevention is preferred to treatment, and a comprehensive health program, which includes quarantine, routine health screens during annual examinations, and necropsy examinations of all animals that die, is desirable.
Descriptors: kidney pathology, kidney diseases, reptiles, blood chemical analysis, diagnosis, differential, kidney anatomy, histology, physiology, kidney diseases diagnosis, pathology, prevention, control, kidney function tests, species specificity, urinalysis.

Soldati, G., Z.H. Lu, L. Vaughan, A. Polkinghorne, D.R. Zimmermann, J.B. Huder, and A. Pospischil (2004). **Detection of mycobacteria and Chlamydiae in granulomatous inflammation of reptiles: A retrospective study.** *Veterinary Pathology* 41(4): 388-397. ISSN: 0300-9858.
Online: http://www.vetpathology.org/cgi/content/abstract/41/4/388
NAL Call Number: 41.8 P27
Abstract: A retrospective study on reptile tissues presenting with granulomatous inflammation was performed to detect the possible presence of mycobacteria and Chlamydiae in these lesions. Ninety cases including 48 snakes, 27 chelonians, and 15 lizards were selected. Mycobacteria were detected by Ziehl-Neelsen (ZN) staining and a broad-range polymerase chain reaction (PCR) followed by DNA sequencing. To detect Chlamydiae, immunohistochemistry with monoclonal antibodies against chlamydial lipopolysaccharide (LPS) and a Chlamydiales order-specific PCR and sequencing were applied. Acid-fast bacilli were found in 14 cases (15.6%) by ZN staining and in 23 cases (25.6%) by PCR. Sequence analysis revealed the presence of Mycobacteria other than *Mycobacterium tuberculosis* complex (MOTT). Chlamydial LPS antigen was observed within granulomas from five samples (5.6%), whereas the PCR screen revealed 58 positive cases (64.4%). Of these, 9 cases (10%) showed 98-99% similarity to Chlamydophila (Cp.) pneumoniae and 49 cases (54.4%) displayed a high similarity (88-97%) to the newly described "Chlamydia-like" microorganisms *Parachlamydia acanthamoebae* and *Simkania negevensis*. Results from this study confirm, on the one hand, that MOTT are probably the most important infectious etiology for granulomatous inflammation in reptiles. On the other hand, they indicate that chlamydia infects reptiles and that *Cp. pneumoniae* should be considered an etiological agent of granulomatous lesions of reptiles. Because both MOTT and *Cp. pneumoniae* are human pathogens, the potential of zoonotic transmission from reptiles to humans has to be considered. In contrast, the significance of Chlamydia-like isolates remains completely open, and further studies are needed to evaluate their role.
Descriptors: reptiles, mycobacteria, chlamydia, granulomatous inflammation, retrospective study, snakes, chelonians, lizards.

Stacy, B.A., J.D. Vidal, A. Osofsky, K. Terio, M. Koski, and H.E. De Cock (2004). **Ovarian papillary cystadenocarcinomas in a green iguana (*Iguana iguana*).** *Journal of Comparative Pathology* 130(2-3): 223-228. ISSN: print: 0021-9975; online: 1532-3129.
Abstract: The clinical, gross morphological and histological characteristics of bilateral ovarian papillary cystadenocarcinomas in an adult female green iguana (*Iguana iguana*) are documented in this report. Histologically, the tumour consisted of an invasive mass of small glandular structures, irregular arboriform papillae and cystic structures arising from the ovarian surface epithelium. Metastatic implants were extensively disseminated along the serosa of the coelomic viscera, mesentery and fat bodies. Tumour morphology and metastatic behaviour indicated a close resemblance to cystadenocarcinoma in other species. Primary ovarian neoplasia is rare in reptiles; documented cases include tumours arising from surface epithelium, germ cells and sex cord stroma.
Descriptors: reptiles, green iguanas, cystadenocarcinoma, ovarian papillary, ovarian neoplasms, pathology, clinical gross morphological characteristics.

Stahl, S.J. (2003). **Diseases of the reptile pancreas.** *Veterinary Clinics of North America, Exotic Animal Practice* 6(1): 191-212. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: A great deal of research is still needed to better understand the reptile pancreas especially with regard to diagnosis and treatment. However, vigilant clinicians and pathologists have important roles to play in expanding our knowledge base in this field, and are encouraged to share their findings through publications and presentations.
Descriptors: reptiles, pancreatic diseases, veterinary , diagnosis, treatment.

Steininger, C., J. van Lunzen, I. Sobottka, H. Rohde, M.A. Horstkotte, and H.J. Stellbrink (2005). **Mycotic brain abscess caused by opportunistic reptile pathogen.** *Emerging Infectious Diseases* 11(2): 349-350. ISSN: print: 1080-6040; online: 1080-6059.
NAL Call Number: RA648.5.E46
Descriptors: reptile, brain abscess, fungal infections, chrysosporium growth, antifungal agents, therapeutic use, brain abscess diagnosis, drug therapy.

Steinman, A., C. Banet Noach, S. Tal, O. Levi, L. Simanov, S. Perk, M. Malkinson, and N. Shpigel (2003). **West Nile virus infection in crocodiles.** *Emerging Infectious Diseases* 9(7): 887-889. ISSN: print: 1080-6040; online: 1080-6059.
NAL Call Number: RA648.5.E46
Descriptors: reptiles, crocodiles, West Nile virus infection, emerging infectious diseases.

Steinman, A., C. Banet Noach, L. Simanov, N. Grinfeld, Z. Aizenberg, O. Levi, D. Lahav, M. Malkinson, S. Perk, and N.Y. Shpigel (2006). **Experimental infection of common garter snakes (T *hamnophis sirtalis*) with west nile virus**. *Vector Borne and Zoontic Diseases* 6(4): 361-368. ISSN: 1530-3667.
NAL Call Number: RA639.5.V43
Descriptors: reptiles, common garter snakes, T*hamnophis sirtalis*, experimental infection, West Nile virus, subcutaneously, orally, viremic, titers, viral RNA.

Stenos, J., S. Graves, V.L. Popov, and D.H. Walker (2003). ***Aponomma hydrosauri*, the reptile-associated tick reservoir of *Rickettsia honei* on Flinders Island, Australia**. *American Journal of Tropical Medicine and Hygiene* 69(3): 314-317. ISSN: 0002-9637.
Online: http://www.ajtmh.org/cgi/content/abstract/69/3/314?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&author1=stenos&fulltext=reptile&andorexactfulltext=and&searchid=1&FIRSTINDEX=0&sortspec=relevance&resourcetype=HWCIT
Abstract: *Rickettsia honei* is the aetiological agent of Flinders Island (Australia) spotted fever. The tick *Aponomma hydrosauri* is associated with reptiles and is the arthropod reservoir for this rickettsia on Flinders Island. The rickettsia appears to be maintained in the tick via vertical transmission. Of 46 ticks examined, 29 (63%) were positive for spotted fever group rickettsiae by detection of the citrate synthase gene by a polymerase chain reaction (PCR). From the positive tick samples, seven were sequenced and found to be 100% homologous with *R. honei*. Of 17 reptiles examined, none had evidence of rickettsiae by PCR or culture of blood. *Courtesty of CAB Abstracts.*
Descriptors: reptiles, tick reservoir, rickettsia, spotted fever, arthropod reservoir, vertical transmission, Australia.

Swanson, K.I. and D.E. Norris (2007). **Detection of *Borrelia burgdorferi* DNA in Lizards from Southern Maryland.** *Vector Borne and Zoonotic Diseases* 7(1): 42-49. ISSN: 1530-3667.
NAL Call Number: RA639.5.V43
Abstract: Lizards serve as hosts for *Ixodes* ticks in the western and southeastern United States and may affect the transmission cycles of *Borrelia burgdorferi* in these regions. In Maryland, the role of lizards in the maintenance and transmission cycle of this pathogen has not been examined. We tested 29 lizards (*Sceloporus undulatus* and *Eumeces* spp.) and 21 ticks from these lizards for the presence of *B. burgdorferi*. Eight lizards were positive by polymerase chain reaction (PCR) for at least one *B. burgdorferi*-specific marker. This is the first report of *B. burgdorferi sensu stricto* detected in lizards in the mid-Atlantic region. Although the viability of the *B. burgdorferi* in these lizards was unconfirmed, recovery of bacterial DNA in a tail snip suggests that the infections in these lizards were disseminated. This study suggests that some lizards indigenous to the mid-Atlantic region may serve as alternative reservoirs for *B. burgdorferi*. In areas where lizard densities are high, these less efficient reservoirs may affect the enzootic cycle of this tick-borne pathogen.
Descriptors: wild caught lizards, Lyme disease, vector borne, *Borrelia burgdorferi*, DNA, reservoirs, mid-atlantic region, USA.

Sykes, J.M. and J.G. Trupkiewicz (2006). **Reptile neoplasia at the Philadelphia Zoological Garden, 1901-2002.** *Journal of Zoo and Wildlife Medicine* 37(1): 11-19. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, neoplasia, 1901-2002 necropsy reports, slides, veterinary, Philadelphia Zoological Garden.

Tellez, S., V. Briones, S. Gonzalez, F.J. Garcia Pena, J. Altimira, A.I. Vela, M.M. Blanco, C. Ballesteros, J.F. Fernandez Garayzabal, and L. Dominguez (2002). ***Salmonella* septicaemia in a beauty snake (*Elaphe taeniura taeniura*).** *Veterinary Record* 151(1): 28-29. ISSN: 0042-

4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, *Elaphe taeniura taeniura*, snakes , *Salmonella*, salmonellosis, septicemia, histopathology, liver, gall bladder, kidneys, intestines, case studies, clinical aspects, *Salmonella enterica*, subspecies, houtenae, subspecies, diarizonae.

Thomas, A.D., L. Sigler, S. Peucker, J.H. Norton, and A. Nielan (2002). ***Chrysosporium anamorph* of *Nannizziopsis vriesii* associated with fatal cutaneous mycoses in the salt-water crocodile (*Crocodylus porosus*).** *Medical Mycology Official Publication of the International Society for Human and Animal Mycology* 40(2): 143-151. ISSN: print: 1369-3786; online: 1460-2709.
Abstract: The *Chrysosporium anamorph* of *Nannizziopsis vriesii*, recently identified as the cause of cutaneous infections in chameleons and brown tree snakes, was associated with skin infections and deaths in salt-water crocodile (*Crocodylus porosus*) hatchlings on two separate occasions 3 years apart. In all, 48 animals died from the infection. All hatchlings came from the same farm in northern Queensland, Australia.
Descriptors: reptiles, cutaneous mycoses, fatal, saltwater crocodile, chameleons, brown tree snakes, skin infections, *Chyrsoporium anamorph*, *Nannizziopsis vriesii,* Australia.

Torrent, A., S. Deniz, A. Ruiz, P. Calabuig, J. Sicilia, and J. Oros (2002). **Esophageal diverticulum associated with *Aerococcus viridans* infection in a loggerhead sea turtle (*Caretta caretta*).** *Journal of Wildlife Diseases* 38(1): 221-223. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Abstract: A juvenile loggerhead sea turtle (*Caretta caretta*) stranded in Gran Canaria, Spain was necropsied. The turtle was underweight, had sunken eyes, and small amounts of crude oil were in the oral cavity. The most significant lesion was a large esophageal diverticulum at the junction of the esophagus and stomach. The diverticulum was full of gas and green mucoid fluid and a diffuse thick yellow fibrinonecrotic membrane covered the mucosa. The lumen of the diverticulum also contained moderate numbers of cephalopods, crustaceans, and anthropogenic debris including crude oil balls, plastics, and fishing lines. Histologically there was a severe diffuse fibrinonecrotic esophagitis. *Aerococcus viridans* was isolated from the diverticulum. This is the first report of an esophageal diverticulum in a sea turtle. Although *A. viridans* is a known pathogen of lobsters and fishes, there are no reports of *A. viridans* infection in sea turtles.
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, esophageal diverticulum, *Aerococcus viridans*, cephalopods, debris, fishing lines.

Tu, Z.C., W. Eisner, B.N. Kreiswirth, and M.J. Blaser (2005). **Genetic divergence of *Campylobacter fetus* strains of mammal and reptile origins.** *Journal of Clinical Microbiology* 43(7): 3334-3340. ISSN: 0095-1137.
Online: http://dx.doi.org/10.1128/JCM.43.7.3334-3340.2005
NAL Call Number: QR46.J6
Abstract: *Campylobacter fetus* is a gram-negative bacterial pathogen of both humans and animals. Two subspecies have been identified, *Campylobacter fetus subsp. fetus* and *Campy-*

lobacter fetus subsp. venerealis, and there are two serotypes, A and B. To further investigate the genetic diversity among *C. fetus* strains of different origins, subspecies, and serotypes, we performed multiple genetic analyses by utilizing random amplification of polymorphic DNA (RAPD), pulsed-field gel electrophoresis (PFGE), and DNA-DNA hybridization. All 10 primers used for the RAPD analyses can distinguish *C. fetus* strains of reptile and mammal origin, five can differentiate between *C. fetus subsp. fetus* and *C. fetus subsp. venerealis* strains, and four showed differences between type A and type B isolates from mammals. PFGE with SmaI and SalI digestion showed varied genome patterns among different *C. fetus* strains, but for mammalian *C. fetus* isolates, genome size was well conserved (mean, 1.52 +/- 0.06 Mb for SmaI and 1.52 +/- 0.05 Mb for SalI). DNA-DNA hybridization demonstrated substantial genomic-homology differences between strains of mammal and reptile origin. In total, these data suggest that *C. fetus subsp fetus* strains of reptile and mammal origin have genetic divergence more extensive than that between the two subspecies and that between the type A and type B strains. Combining these studies with sequence data, we conclude that there has been substantial genetic divergence between *Campylobacter fetus* of reptile and mammal origin. Diagnostic tools have been developed to differentiate among *C. fetus* isolates for taxonomic and epidemiologic uses.

Descriptors: reptiles, campylobacter infections, microbiology, *Campylobacter fetus*, cattle, turtles, bacterial analysis.

Tu, Z.C., G. Zeitlin, J.P. Gagner, T. Keo, B.A. Hanna, and M.J. Blaser (2004). ***Campylobacter fetus* of reptile origin as a human pathogen.** *Journal of Clinical Microbiology* 42(9): 4405-4407. ISSN: 0095-1137.

Online: http://dx.doi.org/10.1128/JCM.42.9.4405-4407.2004

NAL Call Number: QR46.J6

Abstract: A Campylobacter species was isolated from blood from a febrile patient with precursor T-cell acute lymphoblastic leukemia, and after antibiotic treatment, a similar bacterium was isolated from blood 37 days later. Although phenotypic testing did not definitively identify the organisms, molecular analysis indicated that they were the same strain of *Campylobacter fetus* subsp. fetus and were of reptile origin.

Descriptors: reptiles, *Campylobacter fetus*, blood, human pathogen, reptile origin, molecular analysis, zoonoses.

Turutoglu, H., S. Ercelik, and M. Corlu (2005). ***Aeromonas hydrophila*-associated skin lesions and septicaemia in a Nile crocodile (*Crocodylus niloticus*).** *Journal of the South African Veterinary Association* 76(1): 40-42. ISSN: 0038-2809.

NAL Call Number: 41.8 So8

Abstract: *Aeromonas hydrophila* is one of the most common bacteria associated with the aquatic environment. There are, however, limited data on *A. hydrophila* infection in crocodilians. The aim of this report is to describe a case of skin lesions and septicaemia associated with *A. hydrophila* in a Nile crocodile (*Crocodylus niloticus*). A captive male crocodile in the Zoological Park of Antalya (Turkey) was found dead without showing signs of any disease. Gross examination showed brown or red-spotted skin lesions of varying size. These lesions were mostly scattered over the abdomen and occasionally on the tail and feet. At necropsy,

numerous white, multifocal and randomly distributed areas were seen on the liver. Gram-stained smears from skin and liver lesions showed Gram-negative bacilli arranged in clusters. Pure cultures of *A. hydrophila* were recovered from skin, internal organs and blood. Isolates were found to be susceptible to ceftiofur, amoxicillin + clavulanic acid, oxytetracycline, enrofloxacin, danofloxacin, neomycin, gentamicin, and lincomycin + neomycin. A pathogenicity test was performed using this isolate on 4 male 2-year-old New Zealand white rabbits. Local abscesses formed in 2 rabbits injected subcutaneously and the 2 that were injected intraperitoneally died as a result of septicaemia. In conclusion, this report has shown that *A. hydrophila* may cause skin lesions and even death due to septicaemia in crocodiles/
Descriptors: *Aeromonas hydrophila*, isolation, purification, captive crocodiles, gram negative bacterial infections, sepsis, fatal outcome, pathology, liver microbiology, liver pathology, skin pathology, Zoological Park of Antalya Turkey.

Vancraeynest, D., F. Pasmans, A. Martel, K. Chiers, G. Meulemans, J. Mast, P. Zwart, and R. Ducatelle (2006). **Inclusion body disease in snakes: a review and description of three cases in boa constrictors in Belgium.** *Veterinary Record* 158(22): 757-761. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, snakes, Boa constrictor, cytoplasmic inclusions, animal diseases, case studies , inclusion body disease, Belgium.

Vasil'ev, D.B. and I. Solov'ev (2006). **[Ganglioneuroblastoma in Yemenite chameleon (*Chamaeleo calyptratus*): the first recorded case of a tumor of neuroectodermal histogenesis in reptiles]**. *Arkhiv Patologii* 68(4): 45-47 . ISSN: 0004-1955.
Abstract: Nerve tissue tumors are rarely encountered in reptiles and mainly represented by some documented cases of malignant peripheral nerve sheath tumor (MPNST). The paper is the first to describe a tumor mimicking MPNST by some ultrastructural features of tumor cells; however, significantly differing in the combination of immunohistochemical characteristics. Based on the data of electronic microscopy, immunohistochemistry, cytology, and histology, the tumor was classified as ganglioneuroblastoma. Since this nosological entity, unlike MPNST, cannot be assigned to a group of sarcomatoid tumors, the described pathology should be regarded as the first registered case of neuroectodermal histogenesis of tumors in reptiles.
Descriptors: ganglioneuroblastoma veterinary, lizards, chameleon, *Chamaeleo calyptratus*, ganglioneuroblastoma ultrastructure, nerve sheath neoplasms ultrastructure, nerve sheath neoplasms, veterinary.
Language of Text: Russian.

Vasilyev, D.B., Y.N. Solovyev, and V.N. Mitin (2003). **Bone tumors of reptiles.** *Voprosy Onkologii* 49(1): 81-84. ISSN: 0507-3758.
Descriptors: reptiles, bone tumors, disease.
Language of Text: Russian.

Waiswa, C., K. Picozzi, W. Olaho Mukani, and E. Katunguka Rwakishaya (2003). **Monitor lizard (*Varanus niloticus,* linnaeus, 1766) as a host for tsetse (*Glossina fuscipes fuscipes*, newstead, 1910) in the sleeping sickness endemic foci of Uganda.** *African Journal of Ecology* 41(4): 349-351. ISSN: 0141-6707.
NAL Call Number: 409.6 Ea7
Descriptors: reptiles, Monitor lizard, *Varanus niloticus*, diseases, host, tsetse, *Glossina fuscipes fuscipes*, sleeping sickness, Uganda.

Wellehan, J.F. and A.J. Johnson (2005). **Reptile virology.** *Veterinary Clinics of North America, Exotic Animal Practice* 8(1): 27-52. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Reptiles are hosts to diverse viral infections. This article reviews the viruses that are known to infect reptiles and discusses associated pathology, available diagnostic methods, and management techniques for the reptile clinician.
Descriptors: reptiles, virology, virus diseases, viruses isolation, purification, diagnosis, virus diseases, complications, diagnosis, prevention, control.

Wellehan, J.F., A.J. Johnson, B. Harrach, M. Benko, A.P. Pessier, C.M. Johnson, M.M. Garner, A. Childress, and E.R. Jacobson (2004). **Detection and analysis of six lizard adenoviruses by consensus primer PCR provides further evidence of a reptilian origin for the atadenoviruses.** *Journal of Virology* 78(23): 13366-13369. ISSN: 0022-538X.
NAL Call Number: QR360.J6
Abstract: A consensus nested-PCR method was designed for investigation of the DNA polymerase gene of adenoviruses. Gene fragments were amplified and sequenced from six novel adenoviruses from seven lizard species, including four species from which adenoviruses had not previously been reported. Host species included Gila monster, leopard gecko, fat-tail gecko, blue-tongued skink, Tokay gecko, bearded dragon, and mountain chameleon. This is the first sequence information from lizard adenoviruses. Phylogenetic analysis indicated that these viruses belong to the genus Atadenovirus, supporting the reptilian origin of atadenoviruses. This PCR method may be useful for obtaining templates for initial sequencing of novel adenoviruses.
Descriptors: reptiles, lizard, adenoviruses, detection, analysis, consensus primer, PCR, reptilian origin, atadenoviruses, DNA, gecko, Gila monster.

Wellehan, J.F.X., D.K. Nichols, L.L. Li, and V. Kapur (2004). **Three novel herpesviruses associated with stomatitis in Sudan plated lizards (*Gerrhosaurus major*) and a black-lined plated lizard (*Gerrhosaurus nigrolineatus*)**. *Journal of Zoo and Wildlife Medicine* 35(1): 50-54. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, lizards, stomatitis, associated herpesviruses, dyspnea.

Wellehan, J.F.X. and C.I. Gunkel (2004). **Emergent Diseases in Reptiles.** *Seminars in Avian and Exotic Pet Medicine* 13(3): 160-174. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: reptiles, emergent diseases, review, clinical techniques, renal failure, toxicosis.

Westfall, M.E., D.L. Demcovitz, D.R. Plourde, D.S. Rotstein, and D.R. Brown (2006). **In vitro antibiotic susceptibility of *Mycoplasma iguanae* proposed sp. nov. isolated from vertebral lesions of green iguanas (*Iguana iguana*).** *Journal of Zoo and Wildlife Medicine* 37(2): 206-208. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, green iguana, *Iguana iguana*, *Mycoplaama iguana*, amtibiotic susceptibility, in vitro, vertebral lesions, isolated.

Work, T.M. (2005). **Cancer in sea turtles.** *Hawaii Medical Journal* 64(1): 23-24. ISSN: 0017-8594.
Descriptors: sea turtles, neoplasms, pathology, papilloma, etiology, pathology, research, Hawaii.

Work, T.M., G.H. Balazs, M. Wolcott, and R. Morris (2003). **Bacteraemia in free-ranging Hawaiian green turtles *Chelonia mydas* with fibropapillomatosis.** *Diseases of Aquatic Organisms* 53(1): 41-46. ISSN: print: 0177-5103; online: 1616-1586.
Online: http://dx.doi.org/10.3354/dao053041
Abstract: Past studies of free-ranging green turtles *Chelonia mydas* with fibropapillomatosis (FP) in Hawaii have shown that animals become immunosuppressed with increasing severity of this disease. Additionally, preliminary clinical examination of moribund turtles with FP revealed that some animals were also bacteraemic. We tested the hypothesis that bacteraemia in sea turtles is associated with the severity of FP. We captured free-ranging green turtles from areas in Hawaii where FP is absent, and areas where FP has been endemic since the late 1950s. Each turtle was given an FP severity score ranging from 0 (no tumours) to 3 (severely affected). A fifth category included turtles that were stranded ashore and moribund with FP. We found that the percentage of turtles with bacteraemia increased with the severity of FP, and that the majority of bacteria cultured were Vibrio spp. Turtles with severe FP were more susceptible to bactaeremia, probably in part due to immunosuppression. The pattern of bacteraemia in relation to severity of disease strengthens the hypothesis that immunosuppression is a sequel to FP.
Descriptors: reptiles, Hawaiian green turtles, *Chelonia mydas*, bacteraemia , free ranging, fibropapillomatosis, immunosuppressed, tumors, clinical examination.

Wu, H.X. and J.Z. Xue (2004). **Pathogens of haemorrhagic intestinal necrosis in soft-shelled turtle (*Trionyx sinensis*) and their drug sensitivity.** *Chinese Journal of Veterinary Science* 24(4): 343-345 Sum No 112. ISSN: 1005-4545.
NAL Call Number: SF604.C58
Descriptors: reptiles, soft shelled turtle, *Trionyx sinensis*, pathogens, hemorrhagic intestinal necrosis, drug sensitivity.
Language of Text: Chinese; Summary in Chinese and English.

Xia, T.s., J.l. Zhu, and M. Shao (2006). **Relationship between temperature and diseases occurrence of Chinese alligator during hibernation.** *Sichuan Journal of Zoology* 25(2): 400-402. ISSN: 1000-7083.
Descriptors: reptiles, Chinese alligator, temperature, diseases occurrence, relationship.
Language of Text: Chinese; Summary in Chinese and English.

Zhu, L. (2005). **The common diseases found in cultured loggerhead turtle.** *Fisheries Science Liaoning* 24(3): 24-26. ISSN: 1003-1111.
Descriptors: reptiles, loggerhead turtle, common diseases, cultured, captivity.
Language of Text: Chinese.

Zotti, A., P. Selleri, P. Carnier, M. Morgante, and D. Bernardini (2004). **Relationship between metabolic bone disease and bone mineral density measured by dual-energy X-ray absorptiometry in the green iguana (*Iguana iguana*).** *Veterinary Radiology and Ultrasound* 45(1): 10-16. ISSN: 1058-8183.
NAL Call Number: SF757.8.A4
Abstract: The aim of our work was to study the feasibility of using dual-energy X-ray absorptiometry to obtain reference bone density values in relation to body weight, gender, and metabolic bone disease in the green iguana. The study was performed on 28 animals. The weight, age, and gender of each iguana were recorded. Each lizard was carefully examined and radiographed to detect signs of metabolic bone disease. Blood samples were collected from each animal to evaluate Ca/P and total protein. All animals, both affected (group B; n = 11) and unaffected (group A; n = 17) by metabolic bone disease, were individually scanned using an X-ray densitometer. The regions of interest were the head, lumbar spine, right, and left femur. Statistical analysis was performed separately for each region of interest. Body weight had the strongest relationship with bone density ($P < 0.01$). Within regions of interest, for iguanas of average weight (710 g), statistically significant differences between healthy and sick animals were found: head (0.140 vs. 0.090 g/cm2; $P < 0.01$); lumbar spine (0.164 vs. 0.107 g/cm2; $P < 0.01$); right femur (0.103 vs. 0.076 g/cm2; $P < 0.01$); left femur (0.103 vs. 0.078 g/cm2; $P < 0.01$). Regression equations to obtain reference values of bone density as a function of body weight for animals affected and not affected by metabolic bone disease are provided. Our data indicate that X-ray bone densitometry is an additional tool for studying bone pathophysiology in reptiles.
Descriptors: reptiles, iguana, metabolic bone disease, bone mineral density, relationship, duel-energy X-ray absorptiometry, body weight.

General

Alberts, A.C., N.C. Pratt Hawkes and J.A. Phillips (2003). **Ontogeny of captive and wild iguanas: From emergence to mating**. In: E.R. Jacobson *Biology, Husbandry, and Medicine of the Green Iguana,* Krieger Publishing Company: Malabar, USA, p. 28-37. ISBN: 1575240653.
Descriptors: reptiles, green iguana, captive and wild animals, ontogeny, emergence, mating behavior.

Alibardi, L. and M. Toni (2006). **Skin structure and cornification proteins in the soft-shelled turtle *Trionyx spiniferus*.** *Zoology [Jena]* 109(3): 182-195. ISSN: 0944-2006.
NAL Call Number: QL1.Z769
Abstract: In contrast to most chelonians, the fully aquatic soft-shelled turtles have a smooth, unscaled, and pliable shell. The skin of the shell, tail, limbs, and neck of juveniles of *Trionyx spiniferus* has been studied by ultrastructural, immunocytochemical, and immunoblotting methods. The epidermis of the carapace and plastron has a thick corneous layer composed of alpha-corneocytes surrounded by a cornified cell envelope. The softer epidermis is similar to that of the shell but the epidermis and corneous layer are much thinner. Pre-corneous cells in both soft and shell epidermis are rich in vesicles produced in the Golgi apparatus and smooth endoplasmic vesicles, and contain numerous dense-core mucus-like and vesicular (lamellar) bodies. Secreted material is present among corneocytes where it probably forms an extensive intercellular lipid-mucus waterproof barrier. The dermis is very thick and composed of several layers of collagen bundles that form a plywood-patterned dermis. This dermis constitutes a strong mechanical barrier that compensates for the low content in beta-keratin, and lack of cornified scutes and dermal bones. The growth of the shell mainly occurs along the lateral margins. Immunocytochemistry reveals the presence of some beta-keratin in soft and shell epidermis, and this is confirmed by immunoblotting where bands at 18 and 32-35 kDa are present. Other proteins of the cornified cell envelope (loricrin and sciellin) or associated to lipid trafficking (caveolin-1) are also detected by immunoblotting. Loricrin positive bands at 24 and 57 kDa are present while bands cross-reactive for sciellin are seen at 45 and 53 kDa. Caveolin-1 positive bands are seen at 21-22 kDa. The presence of these proteins indicates that the epidermis is both coriaceous and waterproof. These results suggest that the shell of Trionyx is tough enough to be as mechanically efficient as the hard shell of the other turtles. At the same time, a soft shell is lighter, its shape is more easily controlled by muscles, and it allows a more controlled closure and retraction of limbs and neck inside the shell. Thus, the shell makes the animal more streamlined for swimming.
Descriptors: reptiles, swimming, soft shelled turtles, *Trionyx spiniferus*, skin structure, chelonians, aquatic, cornification proteins, pliable shell, ultrastructural.

Anonymous (2003). **Interesting reptiles and amphibians.** *CCA Ecological Journal* 5: 64.
Descriptors: amphibians, reptiles, South Africa.

Anonymous (2005). **Recent literature on freshewater turtles, tortoises and marine turtles.** *Chelonian Conservation and Biology* 4(4): 961-973. ISSN: 1071-8443.
Descriptors: conservation, biology, reptiles, turtles, tortoises, marine turtles, freshwater, recent literature.

Anonymous (2003). **Recent literature on freshwater turtles, tortoises, and marine turtles.** *Chelonian Conservation and Biology* 4(3): 743-751. ISSN: 1071-8443.
Descriptors: conservation, biology, reptiles, freshwater turtles, tortoises, marine turtles, recent literature.

Baines, F.M. and R.R. Davies (2004). **The euthanasia of reptiles.** *Herptile* 29(2): 60-71. ISSN: 0953-2021.
Descriptors: reptiles, euthanasia, methods, techniques , efficacy, humane.

Barten, S.L. (2002). **Ten commonly believed myths concerning captive reptiles.** *Proceedings of the North American Veterinary Conference.* 16(16): 896-899. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, pets, ten common myths, captive, conference proceedings.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida.

Beck, D.D. (2005). ***Biology of Gila Monsters and Beaded Lizards***, Organisms and Environments, University of California Press: Berkeley, CA, 211 p. ISBN: 0520243579.
NAL Call Number: QL666.L247 B43 2005
Descriptors: reptiles, gila monster, beaded lizards, Helodermatidae.

Benko, M., P. Elo, K. Ursu, W. Ahne, S.E. LaPatra, D. Thomson, and B. Harrach (2002). **First molecular evidence for the existence of distinct fish and snake adenoviruses.** *Journal of Virology* 76(19): 10056-10059. ISSN: 0022-538X.
NAL Call Number: QR360.J6
Abstract: From adenovirus-like viruses originating from a fish and a snake species, a conserved part of the adenoviral DNA polymerase gene was PCR amplified, cloned and sequenced. Phylogenetic analysis showed that the snake adenovirus is closely related to the members of the proposed genus Atadenovirus, whereas the fish isolate seems to represent a separate cluster, likely a new genus.
Descriptors: reptiles, snake, adenoviruses, molecular evidence , DNA, phylogenetic analysis.

Birkhead, R.D., M.I. Williams, S.M. Boback, and M.P. Greene (2004). **The cottonmouth condo: a novel venomous snake transport device.** *Herpetological Review* 35(2): 153-154. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, venomous snake, transport device, cottonmouth condo.

Boyer, T.H. (2006). **Common procedures with venomous reptiles.** *Veterinary Clinics of North America, Exotic Animal Practice* 9(2): 269-285. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Venomous reptiles should be handled in a safe and consistent manner, even after death. Owners and staff should be warned not to handle the venomous reptile, and one should have emergency protocols in place before the properly bagged and encased reptile is presented. It is important to know what one is treating as well as one's limitations. After being carefully removed from the bag, the venomous reptile may be transferred to a handling container, tubed, or squeezed with the appropriate equipment. The author usually induces injectable or gas anesthesia at this point. Veterinarians who are inexperienced with venomous reptiles should learn how to handle them through a reputable seminar or class before electing to see them in their practice.
Descriptors: venomous reptiles, bites and stings prevention and control, clinical competence, reptiles, snake venoms adverse effects, snakes, veterinary medicine.

Bucklin, S.E. and A.M. Brinker (2006). ***Crotaphytus collaris* (eastern collared lizard).** *Herpetological Review* 37(2): 240. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, *Crotaphytus collaris*, eastern collard lizard.

Burghardt, G.M. (2004). **Iguana research: looking back and looking ahead.** In: A.C. Alberts, R.L. Carter, W.K. Hayes and E.P. Martins (Editors), *Iguanas: Biology and Conservation.,* University of California Press: Berkeley, Los Angeles and London., p. 1-12. ISBN: 0520238540.
Descriptors: reptiles, iguanas, biology, conservation, research, book chapter.

Burridge, M.J. and L.A. Simmons (2003). **Exotic ticks introduced into the United States on imported reptiles from 1962 to 2001 and their potential roles in international dissemination of diseases.** *Veterinary Parasitology* 113(3-4): 289-320. ISSN: 0304-4017.
NAL Call Number: SF810.V4
Abstract: Since 1962, a total of 29 species of exotic ticks have been introduced into the United States on imported reptiles, with 17 species from the genus *Amblyomma*, 11 from the genus *Aponomma* and one from the genus *Hyalomma*. In the absence of measures to control introduction of these importations, some exotic tick species will develop breeding colonies and become established as indigenous species and some tickborne diseases may be introduced to wreak havoc among susceptible native populations. However, formulation of risk assessments and rational control measures have been hampered by a lack of knowledge of these exotic ticks, with much of the available data published in older and relatively obscure publications. This report is an attempt to collate information for all 29 exotic tick species, including previously unpublished data from our laboratory, with particular reference to their geographical distribution, hosts, life cycles and vector potential, and to review methods to minimize their global dissemination.
Descriptors: reptiles, exotic ticks, imported tick borne disease risks, disemination of disease, *Amblyomma*, *Aponomma*, *Hyalomma*, control.

Cebra Thomas, J., F. Tan, S. Sistla, E. Estes, G. Bender, C. Kim, P. Riccio, and S.F. Gilbert (2005). **How the turtle forms its shell: a paracrine hypothesis of carapace formation.** *Journal of Experimental Zoology. Part B. Molecular and Developmental Evolution* 304(6): 558-569. ISSN: print: 1552-5007; online: 1552-5015.
NAL Call Number: QL1.J87
Descriptors: turtle, bone development, anatomy, histology, embryology, bones cytology, chick embryo, evolution, gene expression regulation, genetics.

Cloudsley Thompson, J. (2006). **The colouration and displays of venomous reptiles: A review**. *Herpetological Bulletin* 95: 25-30. ISSN: 1473-0928.
Descriptors: venomous reptiles, coloration, displays, review.

Corrente, M., K.G. Friedrich, A. Madio, C. Desario, V. Tiri, and M. Campolo (2003). **Comparison of different cultural media for the recovery of *Salmonella* strains from reptile faeces**. In: *Erkrankungen der Zootiere: Verhandlungsbericht des 41 Internationalen Symposiums uber die Erkrankungen der Zoo und Wildtiere. [Proceedings of the Institute for Zoo and Wildlife Research, Berlin, No.5],May 28, 2003-June 1, 2003, Rome, Italy,* p. 345.
Descriptors: reptiles, *Salmonella*, cultural media, comparison, reptile feces, strains.

Cowin, S. and J. Cebek (2006). **Feasibility of using plastron markings in young wood turtles (*Glyptemys insculpta*) as a technique for identifying individuals**. *Herpetological Review* 37(3): 305-307. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, wood turtles, *Glyptemys insculpta*, plastron markings, feasability, identifying individuals, technique.

Elsey, R.M. and P.L. Trosclair III (2004). **A new live trap for capturing alligators.** *Herpetological Review* 35(3): 253-255. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles , alligator, *Alligator mississippiensis*, capturing, new live trap.

Engeman, R.M., D.S. Vice, D. York, and K.S. Gruver (2002). **Sustained evaluation of the effectiveness of detector dogs for locating brown tree snakes in cargo outbound from Guam.** *International Biodeterioration and Biodegradation* 49(2-3): 101-106. ISSN: 0964-8305.
NAL Call Number: QH301.I54
Descriptors: reptiles, Colubridae, brown tree snakes, *Boiga irregularis*, detection, detector dogs, odors, sea-transportation, container transport, effectiveness, inspection, Guam.
Notes: In the special issue: Vertebrate Deteriogens: Management of Vertebrate Pests and Over-abundant Wildlife / edited by M.W. Fall and W.B. Jackson.

Ernst, C.H. and E.M. Ernst (2006). **Synopsis of helminths endoparasitic in snakes of the United States and Canada.** *Society for the Study of Amphibians and Reptiles Herpetological Circular* 34: 1-86. ISSN: 0161-147X.
Descriptors: reptiles, snakes, synopsis, helminths, endoparasites, Canada, USA.

Fidenci, P. (2005). **A new technique for capturing Pacific pond turtles (*Actinemys marmorata*) and a comparison with traditional trapping methods.** *Herpetological Review* 36(3): 266-267. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, Pacific pond turtles, *Actinemys marmorata*, capturing, new technique, traditional trapping methods, comparison.

Funk, R.S. (2002). **Quarantine procedures and protocol for reptiles.** *Proceedings of the North American Veterinary Conference* 16(16): 907-908. ISSN: 0341-6593.
NAL Call Number: SF605.N672
Descriptors: reptiles, quarantine, procedures, protocol, disease control, parasite control, ticks, *Salmonela*.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Gilbert, S. and J. Cebra Thomas (2006). **How turtles form shells: heterotopy and heterochrony**. *Journal of Vertebrate Paleontology* 26(3, Suppl. S): 67A. ISSN: print: 0272-4634; online: 1937-2809.
Descriptors: reptiles, how turtles form shells, heterotopy, heterochrony, meeting.
Notes: Meeting Information: 66th Annual Meeting of the Society of Vertebrate Paleontology, Ottawa, Canada; October 18-21, 2006.

Girling, S. and P. Raiti (Editors) (2004). ***BSAVA Manual of Reptiles. British Small Animal Veterinary Association***, 2nd edition, British Small Animal Veterinary Association: Quedgely, UK, 383 p. ISBN: 0905214757.
NAL Call Number: SF997.5.R4 B74 2004
Descriptors: reptiles, manual, BSAVA, reptiles as pets, veterinary medicine handbook, reptile diseases.

Halpern, M., A.R. Cinelli and D. Wang (2005). **Prey chemical signal transduction in the vomeronasal system of garter snakes.** In: R.T. Mason, M.P. LeMaster and D. Mueller-Schwarze (Editors), *Chemical Signals in Vertebrates 10,* Springer Science+Business Media, Inc.: New York, NY, p. 242-255. ISBN: 0387251596.
NAL Call Number: QP455 .I54 2003
Descriptors: reptiles, garter snakes, vomeronasal system, prey chemical signal transduction.

Heathcote, P. (2005). **General reptile husbandry - Part 4.** *Ratel* 32(2): 21-23. ISSN: 0305-1218.
NAL Call Number: QL77.5.R37
Descriptors: reptiles, care, captivity, husbandry, housing, diet.

Heathcote, P. (2005). **General reptile husbandry - Part 3**. *Ratel* 32(1): 3-4. ISSN: 0305-1218.
NAL Call Number: QL77.5.R37
Descriptors: reptiles, care, captivity, husbandry, diet, nutritional requirements, feeding.

Heathcote, P. (2004). **General reptile husbandry - Part 1**. *Ratel* 31(3): 9-12. ISSN: 0305-1218.
NAL Call Number: QL77.5.R37
Descriptors: reptiles, husbandry, breeding, care.

Hochscheid, S., F. Bentivegna, and J.R. Speakman (2003). **The dual function of the lung in chelonian sea turtles: buoyancy control and oxygen storage.** *Journal of Experimental Marine Biology and Ecology* 297(2): 123-140 . ISSN: 0022-0981.
NAL Call Number: QH91.A1J6
Descriptors: reptiles, chelonian sea turtles, lung, dual function, buoyancy control, oxygen storage.

Huchzermeyer, F.W. (2003). ***Crocodiles: Biology, Husbandry and Diseases***, CABI Publishing: Wallingford, 337 p. ISBN: 0851996566.
Descriptors: reptiles, crocodiles, biology, husbandry, diseases.

Janzen, F.J. and P.C. Phillips (2006). **Exploring the evolution of environmental sex determination, especially in reptiles**. *Journal of Evolutionary Biology* 19(6): 1775-1784. ISSN: 1010-061X.
Descriptors: reptiles, enviornmental sex determination, evolution, temperature sex determination, exploring, lizards, turtles, model organism.

Jeffery, J., M. Norhayati, A. Sulaiman, O. Hidayatulfathi, and S. Sallehudin (2003). **Using the cockroach beaker-trap to trap house-lizards**. *Tropical Biomedicine* 20(1): 91-92. ISSN: 0127-5720.
Descriptors: reptiles, house lizards, bait traps, cockroach beaker trap, traping house lizards.

Johnson, J.H. (2004). **Husbandry and medicine of aquatic reptiles.** *Seminars in Avian and Exotic Pet Medicine* 13(4): 223-228. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: reptiles, aquatic, husbandry, captivity, medicine, treatment, parasites, diseases , disorders, feeding, water quality.

Johnson, M.A. (2005). **A new method of temporarily marking lizards.** *Herpetological Review* 36(3): 277-279. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, lizards, temporarily marking, new method.

Jones, C.G. (2002). **Reptiles and amphibians.** In: M.R. Perrow and A.J. Davy (Editors), *Handbook of Ecological Restoration: Restoration in Practice (Volume 2),* Cambridge University Press: New York, NY, p. 355-375. ISBN: 0521791294.
NAL Call Number: QH541.15.R45 H36 2002
Descriptors: reptiles, amphibians, management, conservation, captive breeding, restoration ecology.

Kenny, M.J., S.E. Shaw, P.D. Hillyard, and A.B. Forbes (2004). **Ectoparasite and haemoparasite risks associated with imported exotic reptiles.** *Veterinary Record* 154(14): 434-435. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, exotic, imported, risks, ectoparasites, hemoparasites, transmission.

Khabibullin, V.F. and M.V. Radygina (2005). **A new trap design to sample small terrestrial lizards.** *Herpetological Review* 36(4): 407-408. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, small terrestrial lizards, new trap design, sample.

Kienzle, E., G. Kopsch, P. Koelle, and M. Clauss (2006). **Chemical composition of turtles and tortoises.** *Journal of Nutrition* 136(7 Suppl): 2053s-2054s. ISSN: 0022-3166.
NAL Call Number: 389.8 J82
Descriptors: reptiles, turtles, tortoises, pets, nutrient requirements, animal feeding, body composition, chemical composition, animal growth, crude protein, ash content, calcium, phosphorus, iron, copper, zinc, liver, turtle shells, tortoise shells.
Notes: Poster presented at the Waltham International Sciences Symposium on "Innovations in Companion Animal Nutrition," September 14 - 18, 2005, Washington, DC.

Knapp, C.R. and A.K. Owens (2005). **An effective new radio transmitter attachment technique for lizards.** *Herpetological Review* 36(3): 264-266. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, lizards, radio telemetry, radio transmitter, attachment technique.

Koehler, G., V. Haecky and B. Eidenmuller (2005). ***Incubation of Reptile Eggs: Basics, Guidelines, Experiences***, Krieger Publishing Company: Malabar, FL, 214 p. ISBN: 1575241935.
Descriptors: reptiles, incubation of eggs, basic care, guidelines, reptiles as pets.
Notes: Translation of: Inkubation von Reptilieneiern, translated by Valerie Haecky.

Krenz, J.G., G.J. Naylor, H.B. Shaffer, and F.J. Janzen (2005). **Molecular phylogenetics and evolution of turtles.** *Molecular Phylogenetics and Evolution* 37(1): 178-191. ISSN: 1055-7903.
NAL Call Number: QH367.5.M56
Abstract: Turtles are one of Earth's most instantly recognizable life forms, distinguished for over 200 million years in the fossil record. Even so, key nodes in the phylogeny of turtles remain uncertain. To address this issue, we sequenced >90% of the nuclear recombination activase gene 1 (RAG-1) for 24 species representing all modern turtle families. RAG-1 exhibited negligible saturation and base composition bias, and extensive base composition homogeneity. Most of the relationships suggested by prior phylogenetic analyses were also supported by RAG-1 and, for at least two critical nodes, with a much higher level of support. RAG-1 also indicates that the enigmatic Platysternidae and Chelydridae, often considered sister taxa based on morphological evidence, are not closely related, although their precise phylogenetic placement in the turtle tree is still unresolved. Although RAG-1 is phylogenetically informative, our research revealed fundamental conflicts among analytical methods for

estimating phylogenetic hypotheses. Maximum parsimony analyses of RAG-1 alone and in combination with two mitochondrial genes suggest the earliest phylogenetic splits separating into three basal branches, the pig-nosed turtles (Carettochelyidae), the softshell turtles (Trionychidae), and a clade comprising all remaining extant turtles. Maximum likelihood and Bayesian analyses group Carettochelyidae and Trionychidae (=Trionychoidae) in their more traditional location as the sister taxon to all other hidden-necked turtles, collectively forming the Cryptodira. Our research highlights the utility of molecular data in identifying issues of character homology in morphological datasets, while shedding valuable light on the biodiversity of a globally imperiled taxon.
Descriptors: pig-nosed turtles, Carettochelyidae, soft shell turtles, Trionychidae, evolution, phylogeny, turtle genetics, base sequence, bayes theorem, mitochondrial DNA, polymerase chain reaction (PCR), sequence analysis, turtles classification, variation genetics.

Li, Y., X. Wu, X. Ji, P. Yan, and G. Amato (2007). **The complete mitochondrial genome of saltwater crocodile (*Crocodylus porosus*) and phylogeny of crocodilians**. *Journal of Genetics and Genomics* 34(2): 119-128. ISSN: 1673-8527.
NAL Call Number: QH426
Descriptors: reptiles, crocodile, *Crocodylus porosus*, salt water, mitochindrial genome, complete, phylogeny, nucleotide sequence.

Lin, Y.J. and J.R. Edelman (2005). **Chromocenters and regeneration of teeth in reptiles: a correlation.** *Nucleus Calcutta* 48(3): 171-172. ISSN: 0029-568X.
Descriptors: reptiles, *Iguana iguana*, chromocenters, regeneration of teeth, correlation.

Lin, Z.H. and X. Ji (2005). **Partial tail loss has no severe effects on energy stores and locomotor performance in a lacertid lizard, *Takydromus septentrionalis*.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 175(8): 567-573. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: Many species of lizards use caudal autotomy as a defense strategy to avoid predation, but tail loss entails costs. These topics were studied experimentally in the northern grass lizard, *Takydromus septentrionalis*. We measured lipids in the three-tail segments removed from each of the 20 experimental lizards (adult females) initially having intact tails to evaluate the effect of tail loss on energy stores; we obtained data on locomotor performance (sprint speed, the maximal length traveled without stopping and the number of stops in the racetrack) for these lizards before and after the tail-removing treatments to evaluate the effect of tail loss on locomotor performance. An independent sample of 20 adult females that retained intact tails was measured for locomotor performance to serve as controls for successive measurements taken for the experimental lizards. The lipids stored in the removed tail was positively correlated with tailbase width when holding the tail length constant, indicating that thicker tails contained more lipids than did thinner tails of the same overall length. Most of the lipids stored in the tail were concentrated in the proximal portion of the tail. Locomotor performance was almost unaffected by tail loss until at least more than 71% of the tail (in length) was lost. Our data show that partial tail loss due to predatory encounters or other

factors may not severely affect energy stores and locomotor performance in *T. septentrionalis.*
Descriptors: reptiles, lacertid lizard, *Takydromus septentrionalis*, partial tail loss, energy stores, effects, locomotor performance, defense strategy, predation.

Lock, B.A. and L. McCaskill (2004). **Operant conditioning for the husbandry and medical management of a large group of adult Nile crocodiles at Disney's Animal Kingdom.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 59-61. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: reptiles, Nile crocodiles, *Crocodylus niloticus*, operant conditioning, husbandry, medical management, captive zoo animals.

Lohmann, C.M. and K.J. Lohmann (2006). **Sea turtles.** *Current Biology* 16(18): R784-R786. ISSN: 0960-9822.
Descriptors: sea turtles, physiology, animal migration, homing behavior, turtles anatomy and histology, turtles classification.

Lohmann, K.J. (2007). **Sea turtles: navigating with magnetism.** *Current Biology* 17(3): R102-R104. ISSN: 0960-9822.
Abstract: Young sea turtles use the Earth's magnetic field as a source of navigational information during their epic transoceanic migrations and while homing. A new study using satellite telemetry has now demonstrated for the first time that adult turtles also navigate using the Earth's magnetic field.
Descriptors: reptiles, sea turtles, navigation, magnetism, Earth's magnetic field, transoceanic migrations.

Macey, J.R., J.A.I. Schulte, J.J. Fong, I. Das, and T.J. Papenfuss (2006). **The complete mitochondrial genome of an agamid lizard from the Afro-Asian subfamily Agaminae and the phylogenetic position of Bufoniceps and Xenagama.** *Molecular Phylogenetics and Evolution* 39(3): 881-886. ISSN: 1055-7903.
NAL Call Number: QH367.5.M56
Descriptors: reptiles, agamid lizard, complete mitochondrial genome , subfamily, Agaminae, Bufoniceps, Xenagama.

MacNeill, A.L., E.W. Uhl, H. Kolenda Roberts, and E. Jacobson (2002). **Mortality in a wood turtle (*Clemmys insculpta*) collection.** *Veterinary Clinical Pathology* 31(3): 133-136. ISSN: 0275-6382.
NAL Call Number: SF601.A54
Descriptors: reptiles, turtles, *Clemmys insculpta*, mortality, liver, symptoms, disease outbreaks, developmental stages, vacuoles, case studies, *Entamoeba invadens*, diagnosis, clinical aspects, case study.

Manley, G.A. (2004). **The lizard basilar papilla and its evolution.** *Springer Handbook of Auditory Research* 22: 200-223. ISSN: 0947-2657.
Descriptors: reptiles, lizard, basilar papilla, evolution, auditory research.

Matsuda, Y., C. Nishida Umehara, H. Tarui, A. Kuroiwa, K. Yamada, T. Isobe, J. Ando, A. Fujiwara, Y. Hirao, O. Nishimura, J. Ishijima, A. Hayashi, T. Saito, T. Murakami, Y. Murakami, S. Kuratani, and K. Agata (2005). **Highly conserved linkage homology between birds and turtles: Bird and turtle chromosomes are precise counterparts of each other.** *Chromosome Research* 13(6): 601-615. ISSN: print: 0967-3849; online: 1573-6849.
NAL Call Number: QH600.C47
Abstract: The karyotypes of birds, turtles and snakes are characterized by two distinct chromosomal components, macrochromosomes and microchromosomes. This close karyological relationship between birds and reptiles has long been a topic of speculation among cytogeneticists and evolutionary biologists; however, there is scarcely any evidence for orthology at the molecular level. To define the conserved chromosome synteny among humans, chickens and reptiles and the process of genome evolution in the amniotes, we constructed comparative cytogenetic maps of the Chinese soft-shelled turtle (*Pelodiscus sinensis*) and the Japanese four-striped rat snake (*Elaphe quadrivirgata*) using cDNA clones of reptile functional genes. Homology between the turtle and chicken chromosomes is highly conserved, with the six largest chromosomes being almost equivalent to each other. On the other hand, homology to chicken chromosomes is lower in the snake than in the turtle. Turtle chromosome 6q and snake chromosome 2p represent conserved synteny with the chicken Z chromosome. These results suggest that the avian and turtle genomes have been well conserved during the evolution of the Arcosauria. The avian and snake sex Z chromosomes were derived from different autosomes in a common ancestor, indicating that the causative genes of sex determination may be different between birds and snakes.
Descriptors: birds, turtles, chromosomes, linkage homology, counterparts, karyotypes, relationship, macrochromosomes, microchromosomes, DNA, karyological relationship.

McCord, W.P. and M. Joseph Ouni (2005). **Chelonian illustrations #19 - American softshell turtles.** *Reptilia GB* 39: 78-81. ISSN: 1138-4913.
Descriptors: reptiles, chelonian illustrations, American softshell turtles, markings.

Merchant, M.E., C. Roche, R.M. Elsey, and J. Prudhomme (2003). **Antibacterial properties of serum from the American alligator (*Alligator mississippiensis*)**. *Comparative Biochemistry and Physiology Part B, Biochemistry and Molecular Biology* 136(3): 505-513. ISSN: 1096-4959.
Descriptors: reptiles, American alligator, *Alligator mississippiensis*, antibacterial properties, blood, serum, *E. coli*, serum complement system.

Metz, M., A.M. Piliponsky, C.C. Chen, V. Lammel, M. eAbrink, G. Pejler, M. Tsai, and S.J. Galli (2006). **Mast cells can enhance resistance to snake and honeybee venoms.** *Science* 313(5786): 526-530. ISSN: 0036-8075.
Abstract: Snake or honeybee envenomation can cause substantial morbidity and mortality, and it has been proposed that the activation of mast cells by snake or insect venoms can contribute to these effects. We show, in contrast, that mast cells can significantly reduce snake-venom-induced pathology in mice, at least in part by releasing carboxypeptidase A and possibly other proteases, which can degrade venom components. Mast cells also significantly

reduced the morbidity and mortality induced by honeybee venom. These findings identify a new biological function for mast cells in enhancing resistance to the morbidity and mortality induced by animal venoms.
Descriptors: reptiles, snake, venoms, honeybee, resistance, mast cells, enhance, reduce snake venom pathology, bee morbidity, mortality.

Miller, H.C. (2006). **Cloacal and buccal swabs are a reliable source of DNA for microsatellite genotyping of reptiles**. *Conservation Genetics* 7(6): 1001-1003. ISSN: 1566-0621.
Descriptors: reptiles, DNA, microsatellite genotyping, cloacal, buccal, swabs, DNA sampling, blood sampling.

Olmo, E. (2005). **Rate of chromosome changes and speciation in reptiles.** *Genetica* 125(2-3): 185-203. ISSN: print: 0016-6707; online: 1573-6857.
Abstract: The chromosome changing rate (i.e. the number of chromosome rearrangements per million years) was studied in 1,329 reptile species in order to evaluate the karyological evolutionary trend and the existence of possible correlations between chromosome mutations and some aspects of the evolution of this class. The results obtained highlight the existence of a general direct correlation between chromosome changing rate and number of living species, although different trends can be observed in the different orders and suborders. In turtles, the separation of pleurodires from cryptodires was accompanied by a considerable karyological diversification. Among pleurodires, the evolution of the Chelidae and Pelomedusidae was also characterised by chromosome variation, while in cryptodires a marked karyological homogeneity is observed between and within infra-orders. Similarly there is no correlation between changing rate and species number in crocodiles, where the evolution of the families and genera has entailed few chromosome mutations. Chromosome variability was greater in lizards and snakes. In the formers variations in chromosome changing rate accompanied the separation of the infra-orders and the evolution of most of the families and of some genera. The origin of snakes has also been accompanied by a marked karyological diversification, while the subsequent evolution of the infra-orders and families has entailed a high level of chromosome variability only in colubroids. The karyological evolution in reptiles generally entailed a progressive reduction in chromosome changing rate, albeit with differences in the diverse orders and suborders. This trend seems to be consistent with the "canalization model" as originally proposed by Bickham and Baker in [Bickham, J.W. & R J. Baker, 1979. Bull. Carnegie Mus. Nat. Hist. 13: 70-84.] However, several inconsistencies have been found excluding that in this class the ultimate goal of chromosome variations was the achievement of a so-called "optimum karyotype" as suggested by the above-mentioned theory. Other mechanisms could underpin chromosome variability in Reptiles. Among them a genomic composition more or less favourable to promoting chromosome rearrangements and factors favouring the fixation of a mutant karyotype in condition of homozygosis. Turtles and crocodiles would have a genome characterised by large chromosomes and a low level of chromosome compartmentalisation limiting the recombination and the frequency of rearrangements. A low rate of chromosome variability modifying little if at all the gene linkage groups would have favoured a conservative evolutionary strategy. In the course of evolution, lizards and snakes could have achieved a genome characterised by smaller chromosomes and

a higher level of compartmentalisation. This would have raised the frequency of recombination and consequently an evolutionary strategy promoting a higher degree of variability and a greater level of speciation.
Descriptors: reptiles, chromosomes genetics, evolution, reptiles classification, reptiles genetics, species specificity.

Packard, G.C. and M.J. Packard (2004). **Natural freeze-tolerance in reptiles.** *CryoLetters* 25(3): 235-236. ISSN: 0143-2044.
Descriptors: reptiles, natural freeze tolerance, temperature, hibernation.

Piantoni, C., N.R. Ibarguengoytia, and V.E. Cussac (2006). **Age and growth of the patagonian lizard *Phymaturus patagonicus*** . *Amphibia Reptilia* 27(3): 385-392. ISSN: 0173-5373.
Descriptors: reptiles, patagonian lizard, *Phymaturus patagonicus*, age, growth, femoral bone analysis, sexual maturity, environment.

Platt, S.G. and T.R. Rainwater (2006). **A review of morphological characters useful for distinguishing Morelet's crocodile (*Crocodylus moreletii*) and American crocodile (*Crocodylus acutus*) with an emphasis on populations in the coastal zone of Belize.** *Bulletin of the Chicago Herpetological Society* 41(2): 25-29. ISSN: 0009-3564.
Descriptors: reptiles, American crocodile, *Crocodylus acutus*, Morelet's crocodile, *Crocodylus moreletii*, distinguishing, morphological characters, review, Belize.

Poschadel, J.R. and D. Moeller (2004). **A versatile field method for tissue sampling on small reptiles and amphibians, applied to pond turtles, newts, frogs and toads.** *Conservation Genetics* 5(6): 865-867. ISSN: 1566-0621.
NAL Call Number: QH75.A1 C56
Descriptors: reptiles, tissue sampling, versatile field method, small reptiles, amphibians, pond turtles, newts, frogs, toads.

Reichard, T. (2004). **Reptile quarantine.** *Iguana* 11(4): 247-249. ISSN: 1554-916X.
Descriptors: reptiles, quarentine, disease transmission, parasites.

Rice, A.N., K.G. Rice, J.H. Waddle, and F.J. Mazzotti (2006). **A portable non-invasive trapping array for sampling amphibians and reptiles**. *Herpetological Review* 37(4): 429-430. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: amphibians, reptiles, sampling, trapping array, portable, non invasive.

Rose, R.J., J. Ng, and J. Melville (2006). **A technique for restraining lizards for field and laboratory measurements.** *Herpetological Review* 37(2): 194-195. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, lizards, restraining, field, laboratory, measurements, technique.

Rosskopf, W.J.J. and M.K. Shindo (2003). **Syndromes and conditions of commonly kept tortoise and turtle species.** *Seminars in Avian and Exotic Pet Medicine* 12(3): 149-161. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: reptiles, tortoise, turtle, syndromes, conditons, common, captive pets.

Rowe, C.L. and S.M. Kelly (2005). **Marking hatchling turtles via intraperitoneal placement of PIT tags: Implications for long-term studies.** *Herpetological Review* 36(4): 408-410. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, hatchling turtles, *Chrysemys picta*, marking, PIT tags, intraperitoneal placement, long term studies.

Seebacher, F. and R. Shine (2004). **Evaluating thermoregulation in reptiles: the fallacy of the inappropriately applied method.** *Physiological and Biochemical Zoology* 77(4): 688-695. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Given the importance of heat in most biological processes, studies on thermoregulation have played a major role in understanding the ecology of ectothermic vertebrates. It is, however, difficult to assess whether body temperature is actually regulated, and several techniques have been developed that allow an objective assessment of thermoregulation. Almost all recent studies on reptiles follow a single methodology that, when used correctly, facilitates comparisons between species, climates, and so on. However, the use of operative temperatures in this methodology assumes zero heat capacity of the study animals and is, therefore, appropriate for small animals only. Operative temperatures represent potentially available body temperatures accurately for small animals but can substantially overestimate the ranges of body temperature available to larger animals whose slower rates of heating and cooling mean that they cannot reach equilibrium if they encounter operative temperatures that change rapidly through either space or time. This error may lead to serious misinterpretations of field data. We derive correction factors specific for body mass and rate of movement that can be used to estimate body temperature null distributions of larger reptiles, thereby overcoming this methodological problem.
Descriptors: reptiles, thermoregulation, evaluating, studies, body temperature, heating, cooling, small animals, large animals, applied method.

Sells, P.G. (2003). **Animal experimentation in snake venom research and in vitro alternatives**. *Toxicon* 42(2): 115-133. ISSN: 0041-0101.
NAL Call Number: 391.8 T66
Descriptors: reptiles, snakes, animal models, envenomation, laboratory animals, rodents, reviews, snake bites, venoms, reduction, alternatives.

Shine, R. (2005). **Life-history evolution in reptiles.** *Annual Review of Ecology Evolution and Systematics* 36: 23-46. ISSN: 1543-592X.
NAL Call Number: QH540.A55
Descriptors: reptiles, life history, evolution.

Sneary, M.G. and E.R. Lewis (2007). **Tuning properties of turtle auditory nerve fibers: Evidence for suppression and adaptation.** *Hearing Research* 228(1-2): 22-30. ISSN: 0378-5955.
Abstract: Second-order reverse correlation (second-order Wiener-kernel analysis) was carried out between spike responses in single afferent units from the basilar papilla of the red-eared turtle and band limited white noise auditory stimuli. For units with best excitatory frequencies (BEFs) below approximately 500Hz, the analysis revealed suppression similar to that observed previously in anuran amphibians. For units with higher BEFs, the analysis revealed dc response with narrow-band tuning centered about the BEF, combined with broad-band ac response at lower frequencies. For all units, the analysis revealed the relative timing and tuning of excitation and various forms of inhibitory or suppressive effects.
Descriptors: reptiles, turtle auditory nerve fibers, tuning properties, suppression, adaptation, auditory stimuli, basal papilla, frequencies.

Spotila, J.R. (2004). ***Sea Turtles: A Complete Guide to Their Biology, Behavior, and Conservation***, Johns Hopkins University Press: Baltimore, MD, 227 p. ISBN: 0801880076.
NAL Call Number: QL666.C536 S69 2004
Descriptors: reptiles, sea turtles, biology, behavior, conservation.

Stahl, S.J. (2003). **Pet lizard conditions and syndromes.** *Seminars in Avian and Exotic Pet Medicine* 12(3): 162-182. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: reptiles, pet lizard, conditions, syndromes, disease, parasites, seminar, veterinary.

Sun, W., P. Neuzil, T.S. Kustandi, S. Oh, and V.D. Samper (2005). **The nature of the gecko lizard adhesive force.** *Biophysical Journal* 89(2): L14-L17. ISSN: print: 0006-3495; online: 1542-0086.
Abstract: The extraordinary climbing skills of gecko lizards have been under investigation for a long time. Here we report results of direct measurement of single spatula forces in air with varying relative humidities and in water, by the force-distance method using an atomic force microscope. We have found that the presence of water strongly affects the adhesion force and from analysis of our results, we have demonstrated that the dominant force involved is the capillary force.
Descriptors: reptiles, gecko, epidermis physiology, ultrastructure, foot anatomy, histology, lizards anatomy, adhesive force, nature, locomotion stress, capillary force.

Tanimoto, M. (2005). **[Jaws of amphibians and reptiles]**. *Clinical Calcium* 15(4): 684-688. ISSN: 0917-5857.
Abstract: Big jaws of amphibians and reptiles are mainly treated in this article. In amphib-

ians enlarged skulls are for the big jaw in contrast with human's skulls for the brain. For example, famous fossils of *Homo diluvii testis* are ones of salamanders in fact. In reptiles, mosasaur jaws and teeth and their ecology are introduced for instance.
Descriptors: amphibia anatomy, histology, jaw anatomy, histology, jaw physiology, reptiles anatomy, histology, ecology.
Language of Text: Japanese.

Tessier, N. and F.J. Lapointe (2003). **Comparative efficiency of different sampling techniques to obtain DNA from freshwater turtles.** *Chelonian Conservation and Biology* 4(3): 710-712. ISSN: 1071-8443.
Descriptors: reptiles, freshwater turtles, obtain DNA, different samplng techniques, comparative efficiency.

Tipton, B.L. (2005). ***Snakes of the Americas: Checklist and Lexicon.***, Krieger Publishing Company: Malabar, 477 p. ISBN: 157524215X.
Descriptors: reptiles, snakes, checklist, North America, South America.

Wilms, T. (2006). **Krustenechsen - die Gattung *Heloderma.* [Venomous lizards - the genus *Heloderma.*]**. *Reptilia D* 11(2): 18-25 Nr 58. ISSN: 1431-8997.
Descriptors: reptiles, *Heloderma*, venomous lizards.
Language of Text: German.

Wilson, K.A., P.M. Cavanagh, and J. Willepique (2003). **Radiotransmitter attachment technique for box turtles (*Terrapene* spp.).** *Chelonian Conservation and Biology* 4(3): 688-691. ISSN: 1071-8443.
Descriptors: reptiles, box turtles, radiotransmitter attachment, technique, *Terrapene* spp.

Winne, C.T., J.D. Willson, K.M. Andrews, and R.N. Reed (2006). **Efficacy of marking snakes with disposable medical cautery units.** *Herpetological Review* 37(1): 52-54. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, snakes, marking, disposable medical cautery units, efficacy.

Woolley, S.C., J.T. Sakata, and D. Crews (2004). **Tracing the evolution of brain and behavior using two related species of whiptail lizards: *Cnemidophorus uniparens* and *Cnemidophorus inornatus.*** *ILAR Journal* 45(1): 46-53. ISSN: 1084-2020.
Online: http://dels.nas.edu/ilar_n/ilarjournal/45_1/html/v4501woolley.shtml
NAL Call Number: QL55.A1I43
Descriptors: reptiles, whiptail lizards, *Cnemidophorus uniparens*, *Cnemidophorus inornatus*, laboratory animals, animal models, females, parthenogenesis, triploidy, diploidy, dopamine, hormone receptors, literature reviews.

Wright, K. (2005). **Reducing the incidence of reproductive problems in snakes and lizards.** *Exotic DVM* 7(3): 58-62. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, snakes, lizards, reproductive problems, reducing the incidence.

Zheng, J.F. and M.Y. Zhu (2005). **Construction and characterization of a cDNA library from kidney/ urogenital complex tissues of one-week-old embryos of the softshelled turtle *Trionyx sinensis.*** *Acta Zoologica Sinica* 51(6): 1156-1161. ISSN: 0001-7302.
Descriptors: reptiles, softshelled turtle, *Trionyx sinensis*, construction, cDNA library, kidney, urogenital tissue complex.
Language of Text: Chinese.

Immunity

Hassl, A. (2005). **Snake egg immunoglobulins: biochemical characteristics and adjusted isolation procedure.** *Journal of Immunological Methods* 297(1-2): 253-257. ISSN: 0022-1759.
NAL Call Number: QL180.J6
Abstract: Transmission of specific immunoglobulins from mothers to their offspring via the egg is a common phenomenon in egg-laying vertebrates but the occurrence of this phenomenon in reptiles, especially in colubrid snakes, has not been proven until recently. Thus, the essential biochemical characteristics of antibodies deposited in eggs of *Elaphe guttata* (Colubridae, Serpentes) were studied after isolation of the antibody by precipitation and purification by affinity chromatography and gel filtration, with verification by isoelectric focusing and immunoprecipitation. The immunoglobulin deposited in the eggs of colubrid snakes is a singular, non-truncated IgY antibody in a concentration roughly equal to that in the snake's serum. An efficient method to isolate antibody from snake eggs was developed, based on the PEG precipitation technique of avian yolk immunoglobulins; an unsophisticated protocol for the isolation procedure appropriate for reptile eggs is provided.
Descriptors: snakes, Colubridae, immunoglobulins analysis and isolation, egg protein analysis, ovum.

Merchant, M., D. Thibodeaux, K. Loubser, and R.M. Elsey (2004). **Amoebacidal effects of serum from the American alligator (*Alligator mississippiensis*).** *Journal of Parasitology* 90(6): 1480-1483. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Descriptors: reptiles, American alligator, *Alligator mississippiensis*, serum, effects, amoebacidal.

Si, K.Y., Z.H. Liu, S.Y. Yu, and Z.R. Wang (2005). **Study on GAP-43 immunoreactivity in the retina of adult fish (*Carp brocarded*), lizard (*Phrynocephalus prezewalskic*), pheasant (*Phasianus colchicus*).** *Journal of Lanzhou University Natural Sciences* 41(3): 36-40 Sum 159. ISSN: 0455-2059.
Descriptors: reptiles, fish, *Carp brocarded*, lizard, *Phrynocephalus prezewalskic*, pheasant, *Phasianus colchicus*, retina, immunoreactivity, GAP-43, study.
Language of Text: Chinese; Summary in Chinese and English.

Trandaburu, I., T. Trandaburu, and L. Ungureanu (2002(2004) janvier-decembre). **Neuropeptide tyrosine (NPY) immunoreactivity in the gastrointestinal tract of several reptiles.** *Revue Roumaine De Biologie Serie De Biologie Animale* 47(1-2): 79-86. ISSN: 0377-8142.
Descriptors: reptiles, turtles, lizards, snakes, neuropeptide tyrosine, immunoreactivity, gastrointestinsl tract, NPY.

Uller, T., M. Olsson, and T. Madsen (2003). **Family and population effects on disease resistance in a reptile.** *Heredity* 91(2): 112-116. ISSN: 0018-067X.

Abstract: Despite its importance in evolutionary biology, studies of the pattern of disease resistance in natural populations are rare. In this paper, we report patterns of infection of a viral eye disease in juvenile Swedish common lizards (*Lacerta vivipara*). Females were sampled at random from natural populations immediately prior to parturition with equal exposure of pathogens for all lizards once in captivity. No causative agents could be found that linked risk of disease to maternal/interfollicular transfer of pathogens. The results show that a major factor influencing offspring susceptibility is family identity, suggesting heritable variation in pathogen resistance. Our interpopulation comparison provides additional support for a link between genetics and disease resistance. Lizards in northern Sweden were not only more susceptible to the disease but were also more health compromised once infected, with relatively more reduced growth rate and increased mortality than lizards from the south. This scenario suggests that southern lizards have been under selection for resistance to this pathogen, whereas northern lizards have not, or at least not to the same degree. Thus, this study confirms the importance of genetic (family) effects on pathogen resistance with variation in this trait among natural populations.

Descriptors: reptile, lizards, *Lacerta vivipara*, immunity, natural genetics, immunology, eye infections, viral genetics, viral mortality, population, virology, viruses pathogenicity.

Yang, X. and Y. Zhao (2003). **Impacts of the abiotic and biotic factors on the immune response of soft-shelled turtle.** In: *Proceedings of the Third World Fisheries Congress: Feeding the world with fish in the next millenium - the balance between production and environment,October 31 , 2000-November 3, 2000, Beijing, China,* American Fisheries Society Symposium, 0892-2284, American Fisheries Society: Bethesda, MD, p. 169-175. ISBN: 1888569557.

NAL Call Number: SH3 .A5 no. 38

Descriptors: reptiles, soft shelled turtles, abiotic factors, biotic factors, immune response.

Zhou, X., C. Niu, and R. Sun (2004). **The effects of vitamin E on antiacid stress ability in juvenile soft-shelled turtles (*Pelodiscus sinensis*).** *Comparative Biochemistry and Physiology. Part C Toxicology and Pharmacology* 137(4): 299-305. ISSN: 1532-0456.

Abstract: We determined the effect of dietary supplementation with vitamin E (0-, 50-, 250-, 500-, 1000- and 5000-mg/kg diet for 4 weeks) on antistress ability in juvenile soft-shelled turtle (*Pelodiscus sinensis*). Half of the turtles per dose group were treated by acid stress for 24 h. The results showed that phagocytosis of blood cells in the control group significantly decreased after acid stress while the other five groups had no significant changes compared with those of before stress. Serum bacteriolytic activity in the control group and the group supplemented with 50-mg vitamin E/kg diet significantly decreased after acid stress. The other four groups showed no significant differences compared with those before stress. Serum bactericidal activities in all groups notably decreased after acid stress, but the difference of serum bactericidal activity in before and after stress had a decreased tendency from the control group to the highest dose group. Serum cortisol levels in the control group were significantly increased while the other five groups had no notable increases after acid stress. Liver vitamin E levels in all groups had no notable changes compared with those

before stress but there was a tendency to decrease after acid stress. These results suggest that acid stress depress immune function and increase serum cortisol levels in turtles while vitamin E alleviate the adverse effects caused by acid stress.

Descriptors: reptiles, soft-shelled turtles, *Pelodiscus sinensis*, antacid stress ability, vitamine E, effects, juvenile, dietary supplementation, immune function.

Parasites

Alyousif, M.S. and Y. Al Shawa (2005). ***Eimeria hemprichii* n. sp. (Apicomplexa: Eimeriidae) from the lizard, *Scincus hemprichii* (Sauria: Scincidae) in Saudi Arabia.** *Journal of the Egyptian Society of Parasitology* 35(3): 723-729. ISSN: 1110-0583.
NAL Call Number: QL757.J65
Abstract: *Eimeria hemprichii* n. sp. was described from the gall bladder of the lizard, *Scincus hemprichii* captured at Gazan Province, western region, Saudi Arabia. Sporulated oocysts are ellipsoidal, 34.6x21.4 (32.5-36.3x20.7-22.5) microm. with smooth greenish-yellow bi-layered wall. Micropyle, polar granule and oocyst residuum are absent. Sporocysts are ellipsoidal, 11.6x8.0 (11.2-12.6 x7.5-8.4) microm. Sporosyst residuum is present, but without stieda or substiedal bodies. Sporozoites are elongate, laying head to tail in sporocyst and each one contains a single spherical posterior re-fracttile body.
Descriptors: coccidiosis, veterinary, *Eimeria* isolation, purification, lizards, parasitology, *Eimeria* classification, gallbladder, oocysts isolation, purification, parasite egg count, Saudi Arabia.

Alyousif, M.S. and Y. Al Shawa (2006). ***Eimeria gazani n*. sp. (Apicomplexa:Eimeriidae) from the lizard, *Scincus hemprichii* (Sauria:Scincidae) in Saudi Arabia.** *Journal of the Egyptian Society of Parasitology* 36(2): 577-583. ISSN: 1110-0583.
NAL Call Number: QL757.J65
Abstract: *Eimeria gazani n*. sp. was described from the intestine of the lizard, *Scincus hemprichii* captured at Gazan, western region. Sporulated oocysts ovoidal 23.5 x 19.7 (20.8-25.0 x 19.0-21.2) micro m, with smooth brownish-green bilayered wall. Micropyle present, covered by a dome-shaped cap. Oocyst residu-um and polar granule are present. Sporocysts ellipsoidal, 10.8 x 6.9 (10.0-11.4 x 6.1-7.4) microm., with a prominent Stieda body. Sporocyst residuum present, sporozoites elongate, laying head to tail in sporocysts, each with large and small subspherical refractile globule.
Descriptors: lizard coccidiosis veterinary, *Eimeria* classification, intestinal diseases, parasitic veterinary, lizards parasitology, coccidiosis parasitology, *Eimeria* isolation and purification, gallbladder parasitology, intestinal diseases, parasitic parasitology, oocysts isolation and purification, phylogeny, Saudi Arabia.

Amo, L., J.A. Fargallo, J. Martinez Padilla, J. Millan, P. Lopez, and J. Martin (2005). **Prevalence and intensity of blood and intestinal parasites in a field population of a Mediterranean lizard, *Lacerta lepida*.** *Parasitology Research* 96(6): 413-417. ISSN: 0932-0113.
NAL Call Number: QL757.P377
Abstract: We describe the blood and intestinal parasites in the Ocellated lizard, *Lacerta lepida*, examining the factors that determine the prevalence and intensity of infection of haemogregarines, and the prevalence of coccidia and nematodes. In relation to haemogregarines, no juveniles were detected as being infected, whereas 71.7 % of adults were infected. The prevalence of infection was positively related to the size of the adults. There were no differ-

ences between seasons or sexes in the prevalence or intensity of infection in adults. There were no significant differences in the prevalence of infection by nematodes between ages or sexes, nor in relation to the size of adult lizards, but adult lizards excreting coccidian oocysts tend to be smaller. During the mating period, reproductive activities lead to a decrease in the body condition. However, neither the intensity of haemogregarine's infection nor the prevalence of intestinal parasites was related to the lizards' body condition.
Descriptors: lizard coccidiosis, veterinary, intestinal diseases, parasitic, parasitology, nematode infections, parasitic diseases, occidiosis epidemiology, parasitology, eucoccidiida isolation, purification, pathogenicity, physiology, host parasite relations, intestinal diseases, parasitic epidemiology, nematoda isolation, purification, pathogenicity, physiology, nematode infections, epidemiology.

Amo, L., P. Lopez, and J. Martin (2005). **Prevalence and intensity of haemogregarine blood parasites and their mite vectors in the common wall lizard, *Podarcis muralis*.** *Parasitology Research* 96(6): 378-381. ISSN: 0932-0113.
NAL Call Number: QL757.P377
Abstract: We describe the general field population biology of haemogregarines and mites in the wall lizard, *Podarcis muralis*, examining the factors that determine the prevalence and intensity of infection. The intensity of infection by haemogregarines in females was slightly lower in summer than in spring, whereas males maintained similar levels of intensity among all the seasons, probably due to immunosuppressive effects of testosterone. This is also supported because the prevalence and the infection intensity by mites were higher in males than in females. Parasite load was higher in lizards with better body condition, which could be reflecting the mortality of infected lizards with poor condition.
Descriptors: lizard coccidiosis, veterinary , *Eucoccidiida* isolation, purification, parasitology, mite infestations, microbiology, protozoan infections. epidemiology, parasitology, transmission, pathogenicity, host parasite relations, insect vectors, animal parasitology, protozoan infections, transmission.

Amo, L., P. Lopez, and J. Martin (2004). **Prevalence and intensity of haemogregarinid blood parasites in a population of the Iberian rock lizard, *Lacerta monticola*.** *Parasitology Research* 94(4): 290-293. ISSN: 0932-0113.
NAL Call Number: QL757.P377
Abstract: The study of the effect of parasites on their host populations is essential for understanding their role in host population dynamics and ecology. We describe the general field population biology of haemogregarines in the Iberian rock lizard, *Lacerta monticola*, examining the factors that determine the prevalence and intensity of infection. Prevalence and infection intensity were higher in adults than in juvenile lizards. The prevalence rate was higher in larger lizards, probably because they were also older and had been more often in contact with parasites during their lifetime. During the mating season, the intensity of parasite infection was greater in males than in females, probably due to immunosuppressive effects of testosterone. The parasite load had a negative effect on the body condition during the reproductive season. The results suggest that the interactions between parasites and hosts are not stable in this lizard population.

Descriptors: reptiles, rock lizard, blood parasites, hemogregarinid, prevalence, negative body condition, intensity, host population, seasonal effects.

Amore, G., L. Tomassone, E. Grego, C. Ragagli, L. Bertolotti, P. Nebbia, S. Rosati, and A. Mannelli (2007). ***Borrelia lusitaniae* in immature *Ixodes ricinus* (Acari: Ixodidae) feeding on common wall lizards in Tuscany, central Italy.** *Journal of Medical Entomology* 44(2): 303-307. ISSN: 0022-2585.

NAL Call Number: 421 J828

Abstract: Lizards and small rodents were live captured in Tuscany, central Italy, from May through August 2005. Prevalence of infestation by larval *Ixodes ricinus L*. (Acari: Ixodidae) and mean numbers of larvae per host were not significantly different for common wall lizards, *Podarcis muralis Laurenti*, and *Apodemus* spp. mice, whereas infestation levels by nymphs were significantly greater on lizards. *Borrelia lusitaniae*, which was previously shown to be dominant in host-seeking *I. ricinus* in the same study area, was detected by polymerase chain reaction (PCR) in 19.8% (95% confidence interval: 14.4, 26.0) of larval ticks and in 52.9% (27.8, 77.0) of nymphs that were collected from lizards. Moreover, 18.8% (7.2, 36.4) and 25.0 (3.2, 65.1) of lizards' tail biopsies and blood samples, respectively, were positive for *B. lusitaniae*. Conversely, attached ticks and ear biopsies from Apodemus spp. mice were PCR negative. Passerine birds belonging to 10 species were live captured in March 2005, and *Borrelia valaisiana* was detected in 57.1% (18.4, 90.1) of *I. ricinus* nymphs feeding on Eurasian blackbirds, *Turdus merula L*. Results of this study suggest that lizards play an important role as reservoirs for *B. lusitanae* and may affect the dominance of this genospecies in the Mediterranean area.

Descriptors: reptiles, wall lizards, small rodents, *Ixodes*, *Borrelia lusitaniae*, feeding, reservoirs, Mediterranean area.

Anjos, L.A., C.F. Rocha, D. Vrcibradic, and J.J. Vicente (2005). **Helminths of the exotic lizard *Hemidactylus mabouia* from a rock outcrop area in southeastern Brazil.** *Journal of Helminthology* 79(4): 307-313. ISSN: 0022-149X.

NAL Call Number: 436.8 J82

Abstract: The helminth fauna of 291 *Hemidactylus mabouia* (Lacertilia: Gekkonidae) from a rock outcrop area in the state of Sao Paulo, Southeastern Brazil, was studied. Five species were recovered, namely one unidentified species of centrorhynchid acanthocephalan (present only as cystacanths) and the nematodes *Parapharyngodon sceleratus*, *P. largitor* (Oxyuroidea: Pharingodonidae), Physaloptera sp. (Spiruroidea: Physalopteridae) and one indeterminate species of Acuariidae (Acuaroidea), with the latter two forms present only as larvae. Infection rates tended to increase with host size, but appeared to be unaffected by season. *Hemidactylus mabouia* shared most of its helminth fauna with two other sympatric lizard hosts, *Mabuya frenata* and *Tropidurus itambere*. The helminth assemblage of the *H. mabouia* population appears to have been entirely acquired by this exotic gecko from the local helminth species pool, rather than possessing any species from the parasite faunas of the original African populations.

Descriptors: amphibians, helminthiasis, parasitology, intestinal diseases, parasitology, lizards, nematoda isolation, purification, host parasite relations, larva, seasons, Brazil.

Beck, W. (2003). **Praxisrelevante Ektoparasitosen und Dermatophytosen bei kleinen Heimsaugern, Vogeln und Reptilien. [Common ectoparasitic diseases and dermatophytoses in small mammals, birds and reptiles].** *Praktische Tierarzt* 84(10): 752-762. ISSN: 0032-681X.
NAL Call Number: 41.8 P882
Descriptors: reptiles, common ectoparasitic diseases, dermatophytoses, birds, small mammals, diagnosis, treatment.
Language of Text: German; Summary in English.

Borkovcova, M. and J. Kopriva (2005). **Parasitic helminths of reptiles (Reptilia) in South Moravia (Czech Republic).** *Parasitology Research* 95(1): 77-78. ISSN: 0932-0113.
NAL Call Number: QL757.P377
Abstract: An helminthological investigation of 104 reptile species was carried out in south Moravia (Czech Republic). We examined *Lacerta viridis*, *L. agilis*, *Anguis fragilis*, *Natrix natrix*, *Coronella austriaca* and *Vipera berus*. Twelve species of parasites were found. Among these, Nematoda occurred most often, followed by Trematoda and Cestoda. No Acanthocephala were detected.
Descriptors: reptiles, helminths, parasitology, cestoda, isolation, purification, nematoda isolation, purification, Czech Republic.

Bouamer, S. and S. Morand (2006). **A new nematode (Nematoda: Cosmocercidae) from the lizard, *Chamaeleo inturensis* (Squamata: Chamaeleonidae) from the Democratic Republic of Congo.** *Journal of Parasitology* 92(2): 346-349. ISSN: 0022-3395.
Abstract: *Maracaya africana* n. sp. (Nematoda: Cosmocercidae) from the large intestine of the lizard *Chamaeleo inturensis* collected in Democratic Republic of Congo is described and illustrated. This is the first record of a species of *Maracaya Diaz-Ungria* (1963) for Africa. Light microscopy and scanning electron microscopy (SEM) studies revealed morphological differences in the structure of the male caudal end and cephalic end, which enabled us to differentiate these new species from the others. A key for determination of all species in the genus is provided.
Descriptors: lizards, ascaridida infections, intestinal diseases, parasitology, ascaridida anatomy, histology, ultrastructure, infections, cecum, intestinal diseases, Democratic Republic of the Congo.

Bouma, M.J., C.J. Smallridge, C.M. Bull, and J. Komdeur (2007). **Susceptibility to infection by a haemogregarine parasite and the impact of infection in the Australian sleepy lizard *Tiliqua rugosa*.** *Parasitology Research* 100(5): 949-954. ISSN: 0932-0113.
Abstract: The Hamilton and Zuk hypothesis on haemoparasite-mediated sexual selection and certain studies of fitness are based on the assumption that blood parasite infections are detrimental to their hosts. However, there are few reports that have demonstrated harmful effects of endemic blood parasites on fitness in wild populations, and it has even been suggested that they may be non-pathogenic. In this paper, we show that individuals of the Australian sleepy lizard (*Tiliqua rugosa*) have smaller home ranges when they are infected with the haemogregarine blood parasite *Hemolivia mariae* than when no infection can be

detected. An apparently contradictory result was that lizards with larger home ranges were more susceptible to infection under experimental exposure to Hemolivia. We propose that lizards sacrifice defence against pathogens by increased activity, perhaps associated with maintaining home ranges and mating opportunities. As a consequence, they gain higher parasite loads, which in turn inhibit their activity. In this case, the parasite-host interaction may act as a buffer of lizard activity.

Descriptors: reptiles, sleepy lizard, *Tiliqua rugosa*, blood parasites, infection, home ranges, hemogregarine parasite, susceptibility.

Bull, C.M. and D.A. Burzacott (2006). **The influence of parasites on the retention of long-term partnerships in the Australian sleepy lizard, *Tiliqua rugosa*.** *Oecologia* 146(4): 675-680. ISSN: 0028-8549.

NAL Call Number: QL750.O3

Abstract: Many studies have shown that potential partners are less likely to be chosen for mating if they are infected with parasites, although most of those studies have considered short-term choices. This paper shows that the Australian sleepy lizard, *Tiliqua rugosa* (Scincoidea), retains long-term pair fidelity for up to 21 years. However, in some cases pairs separate, and abandoned males have significantly higher tick loads in their last year with their previous female partner than did males that retained their partners from 1 year to the next. These data are consistent with the hypothesis that pair bonds are retained because individuals, both with low infection levels, are less likely to become infected if they remain with the same sexual partner.

Descriptors: lizards, *Tiliqua rugosa*, host parasite relations physiology, lizards parasitology, parasitic diseases, sexual behavior, models, biological, prevalence, tick infestations, Australia.

Burridge, M. (2005). **Controlling and eradicating tick infestations on reptiles.** *Compendium on Continuing Education for the Practicing Veterinarian* 27(5): 371-375. ISSN: 0193-1903.

NAL Call Number: SF601.C66

Descriptors: reptiles, disease transmission, acaricides, permethrin, tick control, Florida, eradicating, infestations.

Burridge, M.J. and L.A. Simmons (2003). **Exotic ticks introduced into the United States on imported reptiles from 1962 to 2001 and their potential roles in international dissemination of diseases.** *Veterinary Parasitology* 113(3-4): 289-320. ISSN: 0304-4017.

NAL Call Number: SF810.V4

Abstract: Since 1962, a total of 29 species of exotic ticks have been introduced into the United States on imported reptiles, with 17 species from the genus *Amblyomma*, 11 from the genus *Aponomma* and one from the genus *Hyalomma*. In the absence of measures to control introduction of these importations, some exotic tick species will develop breeding colonies and become established as indigenous species and some tickborne diseases may be introduced to wreak havoc among susceptible native populations. However, formulation of risk assessments and rational control measures have been hampered by a lack of knowledge of these exotic ticks, with much of the available data published in older and relatively obscure publications. This report is an attempt to collate information for all 29 exotic tick species,

including previously unpublished data from our laboratory, with particular reference to their geographical distribution, hosts, life cycles and vector potential, and to review methods to minimize their global dissemination.
Descriptors: reptiles, exotic ticks, imported tick borne disease risks, disemination of disease, *Amblyomma*, *Aponomma*, *Hyalomma*, control.

Burridge, M.J., L.R. Berube, and T.J. Holt (2006). **Invasive ticks: introduction of *Amblyomma kraneveldi* (Anastos) and other exotic ticks (Acari: Ixodidae) into Florida on imported reptiles.** *International Journal of Acarology* 32(3): 315-321. ISSN: 0164-7954.
Descriptors: reptiles, *Amblyomma*, invasive ticks, introduction, parasites, introduced pests, imported, Florida, USA.

Bursey, C.R. (2002). ***Paradollfusnema telfordi n.* sp. (Nematoda: Cosmocercidae) from the worm lizard, *Rhineura floridana* (Amphisbaenia), of Florida.** *Journal of Parasitology* 88(3): 554-556. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: *Paradollfusnema telfordi n*. sp. (Nematoda: Cosmocercidae) from the large intestine of a worm lizard, *Rhineura floridana*, collected in Florida is described and illustrated. *Paradollfusnema telfordi n*. sp. represents the second species assigned to the genus and is distinguished from the other species on the basis of caudal papillae patterns in the male: *P. telfordi n.* sp. with 8 pairs of precloacal papillae, second pair from anterior much larger than others; *Paradollfusnema amphisbaenia* with 4 or 5 pairs of precloacal papillae, all of equal size.
Descriptors: reptiles, lizards, *Paradollfusnema telfordi n*. sp parasitology, nematoda, anatomy, classification, large intestine.

Bursey, C.R. and S.R. Goldberg (2003). ***Acanthocephalus saurius* n. sp. (Acanthocephala: Echinorhynchidae) and other helminths from the lizard *Norops limifrons* (Sauria: Polychrotidae) from Costa Rica.** *Journal of Parasitology* 89(3): 573-576. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: *Acanthocephalus saurius* n. sp. from the small intestine of *Norops limifrons* collected in Costa Rica is described and illustrated. *Acanthocephalus saurius* n. sp. represents the third acanthocephalan species in which gravid individuals have been found in lizard hosts. In addition to *A. saurius*; 1 species of Trematoda, *Mesocoelium monas*; 3 species of Nematoda, *Piratuba digiticauda, Strongyluris panamaensis*, and *Acuariidae gen* . sp. (larvae in cysts) were found.
Descriptors: reptiles, parsites, lizard, helminths, *Norops limifrons*, *Acanthocephalus saurius*, new species, small intestine, Costa Rica.

Bursey, C.R. and S.R. Goldberg (2002). ***Africana telfordi* n. sp. (Nematoda: Heterakidae) from the lizard, *Enyalioides heterolepsis* (Sauria: Iguanidae) from Panama.** *Journal of Parasitology.* 88(5): 926-928. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: *Africana telfordi* n. sp. (Nematoda: Heterakidae) from the large intestine of the lizard *Enyalioides heterolepsis* collected in Panama is described and illustrated. Africana telfordi

n. sp. represents the seventh species assigned to the genus and the second from the Neotropical Realm. It is distinguished from the other neotropical species, *A. chabaudi*, by the size and shape of the spicules. The spicules of *A. telfordi* are robust, analate, and 366-458 microm in length; those of *A. chabaudi* are narrow, alate, and 644-869 microm in length.
Descriptors: reptiles, lizards, parasites, Nematoda, *Africana telfordi* n. sp., anatomy, histology, large intestine, Panama.

Bursey, C.R., S.R. Goldberg, and S.R.J. Telford (2003). ***Rhabdias anolis n*. sp. (Nematoda: Rhabdiasidae) from the lizard, *Anolis frenatus* (Sauria: Polychrotidae), from Panama.** *Journal of Parasitology.* 89(1): 113-117. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: *Rhabdias anolis n*. sp. from the lungs of *Anolis frenatus* collected in Panama is described and illustrated. *Rhabdias anolis n*. sp. represents the 45th species assigned to the genus and the ninth from the Notropical Realm. It is distinguished from all other Neotropical species by the presence of a pair of sessile lateral papillae on its tail.
Descriptors: reptiles, parasites, lizard, *Anolis frenatus*, lungs parasite, *Rhabdias anolis n*. sp., new species, described, illustrated.

Bursey, C.R., S.R. Goldberg, and S.R.J. Telford (2003). ***Strongyluris panamaensis* n. sp. (Nematoda: Heterakidae) and other helminths from the lizard, *Anolis biporcatus* (Sauria: Polychrotidae), from Panama**. *Journal of Parasitology* 89(1): 118-123. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Descriptors: reptiles, lizard, *Anolis biporcatus*, parasites, nematode, *Strongyluris panamaensis*, helminths, new species, intestine, Panama.

Bursey, C.R., S.R. Goldberg, and F. Kraus (2006). **New genus, new species of Cestoda (Proteocephalidae) from the lizard *Sphenomorphus aignanus* (Squamata: Scincidae) from Papua New Guinea.** *Comparative Parasitology* 73(2): 184-187. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: reptiles, new species of Cestoda, lizard, *Sphenomorphus aignanus*, Papua New Guinea.

Bursey, C.R. and C.A. Manire (2006). ***Angiostoma carettae* n. sp. (Nematoda: Angiostomatidae) from the loggerhead sea turtle *Caretta caretta* (Testudines: Cheloniidae), Florida, U.S.A.** *Comparative Parasitology* 73(2): 253-256. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: reptiles, *Angiostoma carettae*, sea turtle, *Caretta caretta*, new species of nematode, Florida.

Bursey, C.R., K.E. Richardson, and D.J. Richardson (2006). **First North American records of *Kathlania leptura* and *Tonaudia tonaudia* (Nematoda: Kathlanidae), parasites of marine turtles.** *Comparative Parasitology* 73(1): 134-135. ISSN: 1525-2647.
NAL Call Number: QL392.J68

Descriptors: reptiles, marine turtles, *Caretta caretta*, nematode parasites, *Kathlania leptura*, *Tonaudia tonaudia*, new host record.

Casher, L., R. Lane, R. Barrett, and L. Eisen (2002). **Relative importance of lizards and mammals as hosts for ixodid ticks in northern California.** *Experimental and Applied Acarology* 26(1-2): 127-143. ISSN: print: 0168-8162; online: 1572-9702.
NAL Call Number: SB940.E9
Abstract: Lizards and mammals were trapped and examined for ticks from August 1992 to June 1993 in two habitat types, chaparral and woodland-grass, in northern California. Five tick species were collected from mammals (*Dermacentor occidentalis*, *Haemaphysalis leporis-palustris, Ixodes pacificus, I. spinipalpis, I. woodi*), but only *I. pacificus* was found on lizards. *Dermacentor occidentalis, I. pacificus*, and *I. woodi* occurred in both habitats, whereas *H. leporispalustris* and *I. spinipalpis* were found only on animals trapped in chaparral. The tick species most commonly encountered on mammals was *D. occidentalis* in chaparral and *I. pacificus* in woodland-grass. Peak infestation of mammals occurred in spring for *I. pacificus immatures* and *H. leporispalustris*, summer for *D. occidentalis immatures*, fall through spring for *I. woodi immatures*, and fall through winter for *I. spinipalpis*. The primary aim of the study was to quantify the relative importance of the western fence lizard (*Sceloporus occidentalis*), which is reservoir-incompetent for *Borrelia burgdorferi sensu lato* (s.l.), and mammalian *B. burgdorferi* s.l.-reservoirs as hosts for the immature stages of I. pacificus in spring. The estimated relative utilization by *I. pacificus* of the western fence lizard versus mammals was 88% for larvae and 99% for nymphs in chaparral in May. When tick infestation data were corrected for a two-fold lower efficiency of field examinations for rodents than for lizards, the western fence lizard still accounted for 78% of larval and 98% of nymphal feedings. In woodland-grass, 46% of 100 *I. pacificus* larvae and 100% of 52 nymphs recovered from mammals or western fence lizards during May-June were collected from the lizards. However, this may represent an underestimate of the importance of the western fence lizard as a larval host in this habitat because inclement weather during the late May sampling period doubtless resulted in significantly decreased lizard activity. In conclusion, the western fence lizard was more heavily utilized by *I. pacificus* immatures, especially nymphs, than were rodents.
Descriptors: reptiles, lizards, mammals, hosts, ixodid ticks , relative importance, rodents.

Caudell, J.N., J. Whittier, and M.R. Conover (2002). **The effects of haemogregarine-like parasites on brown tree snakes (*Boiga irregularis*) and slatey-grey snakes (*Stegonotus cucullatus*) in Queensland, Australia.** *International Biodeterioration and Biodegradation* 49(2-3): 113-119. ISSN: 0964-8305.
NAL Call Number: QH301.I54
Descriptors: reptiles, Colubridae, snakes, brown tree snakes, *Boiga irregularis*, slate-grey snakes, *Stegonotus cucullatus*, protozoal infections, blood chemistry, pathogenicity, symptoms, biological control agents , pest control, vertebrate pests, Queensland, Australia.
Notes: In the special issue: Vertebrate Deteriogens: Management of Vertebrate Pests and Over-abundant Wildlife / edited by M.W. Fall and W.B. Jackson. Includes references.

Clark, K., A. Hendricks, and D. Burge (2005). **Molecular identification and analysis of *Borrelia burgdorferi sensu lato* in lizards in the southeastern United States.** *Applied and Environmental Microbiology* 71(5): 2616-2625. ISSN: print: 0099-2240; online: 1098-5336.
Online: http://dx.doi.org/10.1128/AEM.71.5.2616-2625.2005
NAL Call Number: 448.3 Ap5
Abstract: Lyme borreliosis (LB) group spirochetes, collectively known as *Borrelia burgdorferi sensu lato*, are distributed worldwide. Wild rodents are acknowledged as the most important reservoir hosts. *Ixodes scapularis* is the primary vector of *B. burgdorferi sensu lato* in the eastern United States, and in the southeastern United States, the larvae and nymphs mostly parasitize certain species of lizards. The primary aim of the present study was to determine whether wild lizards in the southeastern United States are naturally infected with Lyme borreliae. Blood samples obtained from lizards in Florida and South Carolina were tested for the presence of LB spirochetes primarily by using *B. burgdorferi sensu lato*-specific PCR assays that amplify portions of the flagellin (flaB), outer surface protein A (ospA), and 66-kDa protein (p66) genes. Attempts to isolate spirochetes from a small number of PCR-positive lizards failed. However, PCR amplification and sequence analysis of partial flaB, ospA, and p66 gene fragments confirmed numerous strains of *B. burgdorferi sensu lato*, including *Borrelia andersonii*, *Borrelia bissettii* , and *B. burgdorferi sensu stricto*, in blood from lizards from both states. *B. burgdorferi sensu lato* DNA was identified in 86 of 160 (54%) lizards representing nine species and six genera. The high infection prevalence and broad distribution of infection among different lizard species at different sites and at different times of the year suggest that LB spirochetes are established in lizards in the southeastern United States.
Descriptors: lizards, *Borrelia burgdorferi* genetics, microbiology, classification, growth, development, culture media, Lyme disease reservoirs, polymerase chain reaction, ticks.

Cordero Tapia, A., S.C. Gardner, J. Arellano Blanco, and R.B. Inohuye Rivera (2004). ***Learedius learedi* infection in black turtles (*Chelonia mydas agassizii*), Baja California Sur, Mexico.** *Journal of Parasitology.* 90(3): 645-647. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: Black turtle (*Chelonia mydas agassizii*) carcasses, recovered as a result of incidental capture in Magdalena Bay, Mexico, revealed invasion by spirorchiid trematode eggs in liver, kidney, intestines, muscle, heart, pancreas, and duodenum. Seventy-five adult *Learedius learedi* Price, 1934, were recovered from the heart of 1 turtle. Most of the organs showed a mild or absent inflammatory response in histological sections, with the exception of a pancreatic-duodenal section that revealed severe lymphocyte and phagocyte infiltration associated with an infestation of more than 200 eggs. A linear formation of 35 eggs from the pancreas toward the intestinal lumen is described as resembling migration. This is among the first reports of a parasitic infection of *L. learedi* Price 1934, in *C. m. agassizii* in Mexico.
Descriptors: reptiles, black turtles, *Learedius learedi* infection, trematode eggs, liver, kidney, intestines, muscle, heart, pancreas.

Cunha Barros, M., M. Van Sluys, D. Vrcibradic, C.A. Galdino, F.H. Hatano, and C.F. Rocha (2003). **Patterns of infestation by chigger mites in four diurnal lizard species from a Restinga habitat (Jurubatiba) of southeastern Brazil.** *Brazilian Journal of Biology* 63(3): 393-399.

ISSN: 1519-6984.

Abstract: We studied the parasitism by larvae of the chigger mite *Eutrombicula alfreddugesi* on the lizard community of Restinga de Jurubatiba, Rio de Janeiro State, Southeastern Brazil. We investigated the patterns of infestation (prevalence and intensity) of chigger mites in four sympatric lizards: *Tropidurus torquatus, Mabuya agilis, M. macrorhyncha* and *Cnemidophorus littoralis*. All lizards collected were checked for the presence of mites, which were counted under stereomicroscope. We tested the relationship between intensity of infestation and lizard body size for each species using regression analysis. The prevalences and mean intensities (+ one standard deviation) of infestation on each host species were, respectively: 100%; 86.4 + 94.6 in *T. torquatus* (n = 62); 100%; 20.9 + 9.3 in *M. agilis* (n = 7); 100%; 11.1 + 13.1 in *M. macrorhyncha* (n = 12); and 95.2%; 19.1 + 16.8 in *C. littoralis* (n = 21). Only for *C. littoralis* did body size significantly affect the intensity of infestation (r = 0.27, p = 0.02). For all lizard species, the body parts where chiggers occurred with the highest intensity were those of skin folds and joint regions.

Descriptors: reptiles, lizards, mite infestations, body size, mites physiology, host parasite relations, prevalence, Brazil.

Durden, L.A. and C.R. Knapp (2005). **Ticks parasitizing reptiles in the Bahamas.** *Medical and Veterinary Entomology* 19(3): 326-328. ISSN: print: 0269-283X; online: 1365-2915.

NAL Call Number: RA639.M44

Abstract: Two species of reptile ticks, *Amblyomma dissimile* Koch and *Amblyomma torrei* Perez Vigueras (Acari: Ixodidae), are reported from the Bahama Islands for the first time. The widespread neotropical (including the Caribbean and southern Florida) A. dissimile was recovered on Andros Island from three species of reptiles all for the first time: the Andros iguana *Cyclura cychlura cychlura* Cuvier, the Andros curly tail lizard *Leiocephalus carinatus coryi* Schmidt, and the Andros boa *Epicrates striatus fowleri* Sheplan and Schwartz. The iguana tick *A. torrei*, previously known only from Cuba, Puerto Rico and the Cayman Islands, was recovered in the Exuma Islands from the Exuma iguana *Cyclura cychlura figginsi* Barbour. Mean numbers of ticks per host were as high as 36.6 on Mangrove Cay, Andros Island, and 25.8 on Pasture Cay in the Exuma Islands.

Descriptors: ticks, *Ixodidae*, reptiles, parasites, iguana, lizard, boa, reptiles, Bahamas.

Durden, L.A., J.H.J. Oliver, C.W. Banks, and G.N. Vogel (2002). **Parasitism of lizards by immature stages of the blacklegged tick, *Ixodes scapularis* (Acari, Ixodidae).** *Experimental and Applied Acarology* 26(3-4): 257-266. ISSN: print: 0168-8162; online: 1572-9702.

NAL Call Number: SB940.E9

Abstract: From 1982-1985 and 1993-1999, a total of 309 individual reptiles, mostly lizards and snakes, belonging to 12 species (American alligator, six lizard species, five snake species) was captured on St. Catherine's Island, Liberty County, Georgia, USA, and examined for ticks. Three lizard species, the broad-headed skink *Eumeces laticeps*, southeastern 5-lined skink *Eumeces inexpectatus*, and eastern glass lizard *Ophisaurus ventralis*, were severely infested with larvae and nymphs of the blacklegged tick, *Ixodes scapularis*. Ticks were not found on any of the other reptile species. Overall, 80% of 65 E. inexpectatus examined were parasitized by a mean intensity of 21.5 larvae and 88% were parasitized by a mean intensity of

4.8 nymphs. Corresponding figures for E. laticeps (n=56) were 93% and 51.3 for larvae and 89% and 7.4 for nymphs, and for *O. ventralis* (n=3) were 67% and 22.5 for larvae and 100% and 21.3 for nymphs. Larvae and nymphs attached along the lateral grooves of *O. ventralis*. Nymphs attached mainly behind the ears and in the foreleg axillae whereas larvae mainly attached to these sites and on the hindlegs in Eumeces spp. Seasonally, both larvae and nymphs were recorded on lizards from April through October. A unimodal larval peak was recorded in May or June. Seasonal data for nymphs did not reveal any distinct peaks but small bimodal peaks in mean intensities may have occurred (one in early summer, the other in late summer) suggesting that some ticks complete their life cycle in one year, and others in two years, on St. Catherine's Island. Potential epidemiological consequences of these findings with respect to Lyme disease in the southeastern United States are briefly addressed.
Descriptors: reptiles, lizards, parasites, snakes, alligator, skink, blacklegged tick, larvae, nymphs.

Ebraheem, M.H., N.A. Rashdan, H.M. Fayed, and F.H. Galal (2006). **Laboratory studies on the possibility of *Culex (Culex) pipiens* l. to harbour and transmit *Hepatozoon matruhensis* to the Egyptian snake *Psammophis schokari*.** *Journal of the Egyptian Society of Parasitology* 36(1): 241-250 . ISSN: 1110-0583.
NAL Call Number: QL757.J65
Abstract: A successful experimental infection of *Psammophis schokari* snake with Hepatozoon matruhensis through *Culex (Culex) pipiens* bites was carried out under laboratory condition of 20 +/- 1 degrees C and 60-70 % R.H. The period monitored for gametocyte maturation ranged from 38 to 42 days while the recorded prepatent period ranged from 28 to 35 days. The effect of infection was nonsignificant on longevity, incubation period and percenttage of egg hatching (P>0.05). Meanwhile a significant increase (P<0.05) in the pre-oviposition period together with a significant reduction (P<0.001) in the number of eggs deposited of infected females were recorded.
Descriptors: Egyptian snake, coccidia growth, development, coccidiosis, *Culex pipiens*, parasitology, insect vectors parasitology, snakes parasitology, coccidiosis parasitology, coccidiosis transmission, temperature, Egypt.

Eisen, L., R.J. Eisen, and R.S. Lane (2004). **The roles of birds, lizards, and rodents as hosts for the western black-legged tick *Ixodes pacificus*.** *Journal of Vector Ecology* 29(2): 295-308. ISSN: 1081-1710.
NAL Call Number: RA639.S63
Abstract: We compared the infestation by ixodid ticks of lizards, rodents, and birds collected simultaneously within areas representing common habitat types in Mendocino County, CA. Lizards were infested only by *Ixodes pacificus* Cooley and Kohls, birds by *I. pacificus* and *Haemaphysalis leporispalustris* (Packard), and rodents by *I. pacificus, I. spinipalpis* Hadwen and Nuttall, *I. woodi Bishopp*, *Dermacentor occidentalis* Marx, and *D. variabilis* (Say). Infestation by *I. pacificus* larvae and nymphs of lizards (*Sceloporus occidentalis Baird* and Girard; Elgaria spp.) and western gray squirrels (*Sciurus griseus Ord*) (means of 9-35 larvae and 5-6 nymphs per animal) was several times greater than for *Neotoma fuscipes* Baird woodrats, Peromyscus spp. mice, and birds (means of 0.9-3.5 larvae and 0-0.3 nymphs). Overall, Borrelia-refractory

lizards accounted for 84% of I. pacificus larvae and 91% of nymphs collected from animals in dense woodlands. Bird species frequently utilizing tick-questing substrates such as leaf litter (guild I birds) were more heavily infested by *I. pacificus* subadults (5.2 larvae and 1.0 nymphs per bird) than guild IV birds with minimal perceived contact with tick-questing substrates (0.08 larvae and 0.06 nymphs per bird). Notably, guild I birds carried similar larval loads and at least 20-fold higher nymphal loads relative to woodrats and mice. Only guild IV birds carried as few *I. pacificus* nymphs as did these rodents. The ratios of larvae to nymphs suggest that, relative to birds, lizards, and squirrels (infested by 1.3-6.0 larvae per nymph), nocturnally active ground-dwelling rodents such as woodrats and mice are underutilized by the nymphal stage (69 to >100 larvae per nymph). The western gray squirrel and guild I-II birds (e.g., the dark-eyed junco, *Junco hyemalis* [L.]) were the only potential reservoirs of *Borrelia burgdorferi* Johnson, Schmid, Hyde, Steigerwalt, and Brenner (the causative agent of Lyme disease in North America) that were frequently infested with both *I. pacificus* larvae and nymphs and commonly utilized dense woodland habitats.
Descriptors: birds parasitology, host parasite relations, ixodes pathogenicity, lizards parasitology, rodentia parasitology, bird diseases, tick control methods, tick infestations, California USA.

Ernst, C.H. and E.M. Ernst (2006). **Synopsis of helminths endoparasitic in snakes of the United States and Canada.** *Society for the Study of Amphibians and Reptiles Herpetological Circular* 34: 1-86. ISSN: 0161-147X.
Descriptors: reptiles, snakes, synopsis, helminths, endoparasites, Canada, USA.

Ferguson, M.A. and L.R. Smales (2006). **Helminth assemblages of the turtle *Emydura macquarii* (Pleurodira: Chelidae) Queensland, Australia.** *Journal of Parasitology.* 92(1): 186-188. ISSN: 0022-3395.
Abstract: The helminth fauna of 76 *Emydura macquarii* from 3 river systems in central and northern Queensland was examined. Eleven species were found, including 2 nematodes, 6 trematodes, 1 aspidogastrean, 1 cestode, and 1 monogenean. Analysis of helminth diversity showed that the Fitzroy and Ross River turtles had communities of comparable diversity, but the helminth communities in Proserpine River turtles were much less diverse. The helminth communities in all localities were dominated by trematodes. *Polystomoides australiensis* was the most prevalent, being found in 60% of the Ross River turtles, 57% of the Fitzroy River turtles, and 46% of the Proserpine River turtles. *Notopronocephalus peekayi* was the most abundant species, with mean abundances of 5.9 in the Ross River turtles and 9.8 in the Fitzroy River turtles. Species richness, Simpson's Reciprocal Index, was highest, 4.68, for the Ross River helminth community, Sorensen's Qualitative Index showed 95% similarity between the Ross River and Fitzroy River communities, although Sorensen's Quantitative Index indicated only 35% similarity between the 2 sites. Host feeding patterns are likely the most important factor affecting species richness of the helminth infracommunities, as the majority of helminth species are transmitted by food-web interactions involving intermediate hosts.
Descriptors: turtle, *Emydura macquarii*, Cestode infections, helminthiasis, nematode infec-

tions, trematode infections, epidemiology, fresh water, animal parasitology, platyhelminths, Queensland Australia.

Gal, J., M. Mandoki, C. Jakab, E. Sos, and M. Marosan (2003). **Entamoebosis zold leguanban (*Iguana iguana*).[Entamoebiosis in green iguana (*Iguana iguana*)].** *Magyar Allatorvosok Lapja* 125(7): 422-424. ISSN: 0025-004X.
Descriptors: reptiles, iguana, case reports, entamoebosis, clinical aspects.
Language of Text: Hungarian; Summary in English.

Garner, M.M., J.L. Bartholomew, C.M. Whipps, R.W. Nordhausen, and P. Raiti (2005). **Renal myxozoanosis in crowned river turtles *Hardella thurjii*: Description of the putative agent *Myxidium hardella* n. sp. by histopathology, electron microscopy, and DNA sequencing.** *Veterinary Pathology* 42(5): 589-595. ISSN: 0300-9858.
Online: http://www.vetpathology.org/cgi/content/abstract/42/5/589
NAL Call Number: 41.8 P27
Abstract: Chelonian myxozoanosis is rarely reported and has previously not been documented to cause disease. This report describes myxozoanosis associated with significant renal disease in two Crowned River turtles (*Hardella thurjii*). One turtle presented with emaciation and died. The cage mate presented with emaciation and was euthanized. Histologically, renal intratubular myxozoan spores were associated with renal tubular necrosis, tubular mineralization, and chronic interstitial nephritis, with membranoproliferative and mes-angioproliferative glomerulopathy. Both turtles also had disseminated metastatic mineralization. On the basis of these findings, chronic renal insufficiency from myxozoanosis and subsequent metastatic mineralization were considered the primary problems. By light and electron microscopy, the myxozoan spores had features of the genus Myxidium. Maximum parsimony analysis of small-subunit rDNA sequences placed the turtle myxozoan basal to a clade containing *Myxidium truttae* and a Myxidium sp. with strong bootstrap support. This myxozoan agent appears to be a significant pathogen in *H. thurjii* on the basis of morphologic changes in the kidneys of in the infected turtles.
Descriptors: crowned river turtles, *Hardella thurjii*, kidney diseases, parasitology, liver, protozoa, DNA sequencing, renal myxozoanosis.

Ghobashy, M.A. (2006). **Parasitological studies of the lizard, *Ludakia stellio* in Arish, North Sinai Governorate, Egypt.** *Journal of the Egyptian Society of Parasitology* 36(2): 691-700. ISSN: 0253-5890.
NAL Call Number: QL757.J65
Abstract: In the lizard, *Laudakia stellio*, the gastrointestinal tract harboured four helminthic-parasites: two nematodes *Spauligodon auziensis* (Seurate, 1917) *Paraparyngodon bulbosus* (Linstow, 1897), two larval stages of nematode, and one cestode, Oochoristica sp. (Kennedy et al., 1982). The total infection rate of *L. stellio* was 93%. Out of 45 *L. stellio* examined, 42 were infected with number of parasites ranged from 0-72 and mean intensity 11.57. Parasites burden on their host populations was highly aggregated with k value was 0.01. No significant correlation was found between host weight and intensity of infection. The histopathological impact of infection was examined indicating the tissue reaction against the parasite at the site

of attachment.
Descriptors: lizard, *Laudakia stellio*, cestode infections, intestinal diseases, parasites, lizards parasitology, nematode infections, cestode infections, epidemiology, host parasite relations, intestinal diseases, nematode infections, Egypt.

Goldberg, S.R., C.R. Bursey, and M. Morando (2004). **Metazoan endoparasites of 12 species of lizards from Argentina**. *Comparative Parasitology* 71(2): 208-214. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: reptiles, twelve species of lizards, metazoan endoparasites, Argentina.

Goldberg, S.R., C.R. Bursey, and S.R.J. Telford (2003). **Metazoan endoparasites of 11 species of lizards from Pakistan**. *Comparative Parasitology* 70(1): 46-54. ISSN: 1049-233X.
NAL Call Number: QL392.J68
Descriptors: reptiles, eleven species of lizards, metazoan endoparasites, Pakistan.

Goldberg, S.R. and C.R. Bursey (2004). **Helminths of four species of African lizards.** *African Zoology* 39(1): 111-114. ISSN: 1562-7020.
NAL Call Number: QL336.Z6
Descriptors: reptiles, African lizards, four species, helminths, cestoda, nematoda, hosts, prevalence, Africa.

Goldberg, S.R. and C.R. Bursey (2002). **Gastrointestinal helminths of the blackneck garter snake, *Thamnophis cyrtopsis* (Colubridae)**. *Western North American Naturalist* 62(2): 243-245. ISSN: 1527-0904.
Descriptors: reptiles, blackneck garter snake, *Thamnophis cyrtopsis*, gastrointestinal helminths, parasites.

Goldberg, S.R., C.R. Bursey, and K.R. Beaman (2003). **Gastrointestinal helminths of the black-tailed brush lizard, *Urosaurus nigricaudus* (phrynosomatidae), from Baja California Sur, Mexico.** *Bulletin Southern California Academy of Sciences* 102(3): 143-147. ISSN: 0038-3872.
NAL Call Number: 500 So8
Descriptors: reptiles, black tailed bush lizard, *Urosaurus nigricaudus*, gastrointestinal, helminths, Baja, Mexico.

Goldberg, S.R., C.R. Bursey, and J.L. Camarillo Rangel (2003). **Gastrointestinal helminths of seven species of sceloporine lizards from Mexico.** *Southwestern Naturalist* 48(2): 208-217. ISSN: 0038-4909.
NAL Call Number: 409.6 So8
Descriptors: reptiles, sceloporine lizards , gastrointestinal helminths, Mexico.

Goldberg, S.R., C.R. Bursey, and L.J. Vitt (2006). **Parasites of two lizard species, *Anolis punctatus* and *Anolis transversalis* (squamata : polychrotidae) from Brazil and Ecuador**. *Amphibia Reptilia* 27(4): 575-579. ISSN: 0173-5373.
Descriptors: reptiles, parasites, lizards, *Anolis* sp. Brazil, Ecuador.

Greenblatt, R.J., T.M. Work, G.H. Balazs, C.A. Sutton, R.N. Casey, and J.W. Casey (2004). **The Ozobranchus leech is a candidate mechanical vector for the fibropapilloma-associated turtle herpesvirus found latently infecting skin tumors on Hawaiian green turtles (*Chelonia mydas*).** *Virology* 321(1): 101-110. ISSN: 0042-6822.

Abstract: Fibropapillomatosis (FP) of marine turtles is a neoplastic disease of ecological concern. A fibropapilloma-associated turtle herpesvirus (FPTHV) is consistently present, usually at loads exceeding one virus copy per tumor cell. DNA from an array of parasites of green turtles (*Chelonia mydas*) was examined with quantitative PCR (qPCR) to determine whether any carried viral loads are sufficient to implicate them as vectors for FPTHV. Marine leeches (*Ozobranchus* spp.) were found to carry high viral DNA loads; some samples approached 10 million copies per leech. Isopycnic sucrose density gradient/qPCR analysis confirmed that some of these copies were associated with particles of the density of enveloped viruses. The data implicate the marine leech Ozobranchus as a mechanical vector for FPTHV. Quantitative RT-PCR analysis of FPTHV gene expression indicated that most of the FPTHV copies in a fibropapilloma have restricted DNA polymerase expression, suggestive of latent infection.

Descriptors: reptiles, Hawaiian green turtles, *Chelonia mydas*, fibropapilloma, herpesvirus, *Ozobranchus* leech, vector, skin tumor.

Hallas, G. and C.M. Bull (2006). **Influence of drying time on nematode eggs in scats of scincid lizard *Egernia stokesii*.** *Journal of Parasitology.* 92(1): 192-194. ISSN: 0022-3395.

Abstract: Two pharyngodonid nematode species, *Pharyngodon tiliquae* and *Thelandros trachysauri*, infect the Australian lizard *Egernia stokesii* (gidgee skink) in populations from South Australia. Eggs are detected in lizard scats that are deposited in piles outside the rock crevice refuges that the lizards occupy. Eggs were isolated by salt flotation from fresh scats and from scats that had been dried in simulated field conditions for 7, 14, 21, and 28 days. Egg counts decreased with drying time for both nematode species, but *T. trachysauri* eggs were still detected after 28 days of drying, whereas *P. tiliquae* eggs were rarely detected after 14 days. These results suggest that egg counts can be used to infer host infection status only from relatively fresh scats and that eggs of the 2 species persist in a state where they can be detected by standard flotation techniques, for different times.

Descriptors: Australian lizard, *Egernia stokesii* , *Pharyngodon tiliquae*, *Thelandros trachysauri*, feces, lizards parasitology, desiccation, nematoda growth and development, nematode infections, ovum physiology, parasite egg count, time factors.

Hanson, B.A., P.A. Frank, J.W. Mertins, and J.L. Corn (2007). **Tick paralysis of a snake caused by *Amblyomma rotundatum* (Acari: Ixodidae).** *Journal of Medical Entomology* 44(1): 155-157. ISSN: 0022-2585.

NAL Call Number: 421 J828

Abstract: A lethargic southern black racer, *Coluber constrictor priapus* Dunn and Wood, wild-caught in the Florida Keys, Monroe County, FL, was found to be paralyzed by the bite of a female ixodid tick, *Amblyomma rotundatum* Koch (Acari: Ixodidae). Removal of the tick restored the snake to normalcy within 18 h. Other, earlier reported cases of tick toxicosis in reptiles are reviewed and clarified. Evidently, the present incident is the only reported case of

tick paralysis in a poikilotherm found in a natural setting.
Descriptors: reptiles, snake, tick paralysis, paralyzed, female ixodid tick, *Amblyomma rotundatum* , wild caught.

Heideman, N.J.L. (2002). **The occurrence of the arthropod endoparasite, *Raillietiella namibiensis* (pentastomida: cephalobaenida), in the lungs of agamid lizards of windhoek, namibia.** *Herpetological Journal* 12(1): 37-38. ISSN: 0268-0130.
Descriptors: reptiles, arthropod endoparasite, *Raillietiella namibiensis*, agmid lizards, lungs, Nambia.

Helke, K.L., T.K. Cooper, J.L. Mankowski, and S.L. Poynton (2006). **Disseminated visceral coccidiosis in indo-gangetic flap-shelled turtles, *Lissemys punctata andersonii*.** *Journal of Wildlife Diseases* 42(4): 788-796. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: reptiles, flap-shelled turtles, *Lissemys punctata andersonii*, coccidiosis, disseminated visceral, *Eimeria*, lung, liver, auditory canal, pharynx, kidney, spleen.

Helke, K.L. and S.L. Poynton (2005). ***Myxidium mackiei* (Myxosporea) in Indo-Gangetic flap-shelled turtles *Lissemys punctata andersonii*: Parasite-host interaction and ultrastructure.** *Diseases of Aquatic Organisms* 63(2-3): 215-230. ISSN: print: 0177-5103; online: 1616-1580.
Online: http://dx.doi.org/10.3354/dao063215
Abstract: Myxosporeans are common parasites of fish, and uncommon parasites of amphibians, reptiles and invertebrates, that can cause significant morbidity and mortality. The common genus *Myxidium* infects the excretory system of turtles, yet knowledge of its pathogenicity in these hosts is limited. We offer new knowledge of morphological and ultrastructural aspects of host-parasite interactions in *Myxidium* infections from our recent diagnostic investigations on captive freshwater turtles listed in CITES (Appendix II). We investigated the cause of death of 2 adult Indo-Gangetic flap-shelled turtles *Lissemys punctata andersonii* from a zoo collection. After post-mortem examination, tissues were processed for histopathology, and special stains were used to demonstrate morphology of myxosporean spores. Additional kidney tissue, immersion-fixed in formalin, was processed for transmission electron microscopy. Both turtles were infected with a myxosporidian, *Myxidium mackiei*, in the kidney, which occluded 5 to 10% of the renal proximal convoluted tubules. The polysporic plasmodia contained pairs of developing and mature spores. Each mature, spindle-shaped spore had 2 asymmetric valves (1 overlapping, 1 overlapped), with 10 to 13 and 10 to 14 longitudinal ridges per valve, and 2 polar capsules each containing a polar filament with 4 to 5 turns. A pair of spores, each surrounded by a membrane-bound electron-lucent matrix, lay in an enclosing cell within the plasmodium. Regions of the parasite-host interface consisted of undulations of the parasite surface, with intense pinocytotic activity beneath, intermingled with the hosts' microvilli, and endocytotic channels at the apex of renal epithelial cells. The microvilli of the renal epithelial cells of infected tubules were frequently sheared or compressed, or occasionally missing; we did not detect other pathology induced by the parasite. Our report of *M. mackiei* in *L. punctata* is a new host record. Both individuals also

had disseminated pale yellow nodules (bacterial granulomas) present in lung, heart, kidney, and skeletal muscle, and both were infected with coccidia (tentatively identified as Eimeria sp.) in multiple organs. The cause of death for one turtle was septicemia, but remained unknown for the other individual.
Descriptors: reptile, turtles, *Myxidium mackiei*, parasitology, protozoa ultrastructure, infections, spores, fatal outcome, histological techniques, host parasite relations, kidney parasitology, kidney ultrastructure, transmission, parasitemia, mortality, pathogenicity, India.

Horak, I.G., I.J. Mckay, B.T. Henen, H. Heyne, M.D. Hofmey, and A.L. De Villiers (2006). **Parasites of domestic and wild animals in south africa. Xlvii. Ticks of tortoises and other reptiles.** *Onderstepoort Journal of Veterinary Research* 73(3): 215-227. ISSN: 0030-2465.
NAL Call Number: 41.8 On1
Descriptors: reptiles, parasites, tortoises, domestic, wild animals, lizards, snakes, tick species, Amblyomma, Ixodid, South Africa.

Ibrahim, H.M., M.M. Fadiel, and G.A. Nair (2005). **Gastrointestinal helminths of the lizard *Chalcides ocellatus* from Benghazi, Libya.** *Journal of Helminthology* 79(1): 35-39. ISSN: 0022-149X.
NAL Call Number: 436.8 J82
Abstract: *Chalcides ocellatus*, a scincid lizard, sampled during October 1998 to December 1999 from Benina (farmland) and Al-Kueffia (a rocky area) in Benghazi, Libya, was found to harbour three intestinal nematodes, *Pharyngodon mamillatus*, *Thelandros alatus* and *Parapharyngodon micipsae*, and an intestinal cestode, *Oochoristica tuberculata*. *Thelandros alatus*, *P. micipsae* and *O. tuberculata* were recorded for the first time in *C. ocellatus*. *Parapharyngodon micipsa*e was detected in *C. ocellatu*s from Benina and *O. tuberculata* from lizards in Al-Kueffia. The majority (87.6%) of *C. ocellatus* were infected with helminth parasites and the levels of infection were higher in males than in females but this difference was not significant. *Pharyngodon mamillatus* recorded the highest number of nematode parasites in *C. ocellatus*, although there was no relationship between the number of nematode parasites recovered and host density. In lizards infected with the cestode *O. tuberculata*, males had shorter snout-vent lengths than females. From a total of 153 *C. ocellatus*, 120 (78.4%) showed single and 14 (9.2%) showed mixed parasitic infections. Mixed infections between different species of nematodes were not observed.
Descriptors: lizard, *Chalcides ocellatus*, gastrointestinal tract parasites, helminths , parasitology, parasitic diseases, diagnosis, cestoda, helminthiasis, intestinal diseases, nematoda, parasitic diseases, Libya.

Ibrahim, M.M. and M.F. Soliman (2005). **Factors affecting helminths community structure of the Egyptinan lizard *Chalcides ocellatus* (Forskal, 1775).** *Parasite* 12(4): 317-323. ISSN: 1252-607X.
NAL Call Number: QL757.P3737
Abstract: The variation in the component community structure of intestinal helminths in the lizard *Chalcides ocellatus* (Forskal, 1775) was studied in relation to the seasonal variation and host weight and sex. 120 lizards were collected seasonally during year 2004, from

Al Firdan, Ismailia governorate, Egypt. The helminths community consisted of six species (five nematodes and one cestode). The various helminths differed according to host sex. The prevalence of total helminths infection was 67.6 % while the prevalences of *Thelandros schusteri*, *Pharyngodon mamillatus*, *Parapharyngodon bulbosus*, *Cosmocerca vrcibradici*, *Spauligodon petersi* and *Oochoristica maccoyi* were 43.4%, 3.9 %, 13.2%, 5.3%, 6.6%, and 14.3%, respectively. The results showed that the season was the main factor affecting infracommunity species richness and parasite abundance. Moreover, there was interaction between season and host sex on abundance of *P. bulbosus*. The prevalence of intestinal helminths varied significantly in relation to host weight classes and sex in some species. Helminths abundance and intensity were independent from host sex. In addition, correlations were found between total helminths abundance and host weight. In conclusion, the helminths community of *C. ocellatus* was depauperate and the influence of the studied factors varied from species to another one. We cannot say if the low species richness and infection rates observed in the present study are typical of the host species or if they are due to characteristics of the study area, since no available data on parasite assemblages exist for other *C. ocellatus* populations.
Descriptors: lizard, *Chalcides ocellatus*, helminthiasis, parasitology, lizards parasitology, body weight, Egypt, epidemiology, host parasite relations, intestinal diseases, factors, parasitic epidemiology.

Ikramov, E.F. and D.A. Azimov (2003). **Dva novykh vida nematod, obnaruzhennye u amfibii i reptilii v severnoi chasti Ferganskoi doliny. [Two new nematode species found in amphibians and reptiles from the north part of Fergana valley]**. *Parazitologiia* 37(6): 512-516 . ISSN: 0031-1847.
NAL Call Number: QL757.A1P32
Abstract: Two new species of nematodes found, in the north of Fergana Plain (Uzbekistan): *Raillietnema uzbekistanica* sp. n. (Cosmocercidae) from the Horsfields Tortoise *Testudo horstfieldi* (Testudinidae), and *Spironoura govacus* sp. n. (Kathlaniidae) from the green toad *Bufo viridis* (Bufonidae). Data on infection of *R. uzbekistanica* sp. n. with predatory fungi in different seasons are given.
Descriptors: reptiles, green toad, nematodes, two new species, predatory fungi, *Raillietnema uzbekistanica*, Fergana valley Uzbekistan.
Language of Text: Russian.

Jacobson, E.R., B.L. Homer, B.A. Stacy, E.C. Greiner, N.J. Szabo, C.L. Chrisman, F. Origgi, S. Coberley, A.M. Foley, J.H. Landsberg, L. Flewelling, R.Y. Ewing, R. Moretti, S. Schaf, C. Rose, D.R. Mader, G.R. Harman, C.A. Manire, N.S. Mettee, A.P. Mizisin, and G.D. Shelton (2006). **Neurological disease in wild loggerhead sea turtles *Caretta caretta*.** *Diseases of Aquatic Organisms* 70(1-2): 139-154. ISSN: print: 0177-5103; online: 1616-1580.
Online: http://dx.doi.org/10.3354/dao070139
Abstract: Beginning in October 2000, subadult loggerhead sea turtles *Caretta caretta* showing clinical signs of a neurological disorder were found in waters off south Florida, USA. Histopathology indicated generalized and neurologic spirorchiidiasis. In loggerhead sea turtles (LST) with neurospirorchiidiasis, adult trematodes were found in the meninges of the brain and spinal cord of 7 and 3 affected turtles respectively, and multiple encephalic

intravascular or perivascular eggs were associated with granulomatous or mixed leukocytic inflammation, vasculitis, edema, axonal degeneration and occasional necrosis. Adult spirorchiids were dissected from meningeal vessels of 2 of 11 LST brains and 1 of 10 spinal cords and were identified as *Neospirorchis* sp. Affected LST were evaluated for brevetoxins, ciguatoxins, saxitoxins, domoic acid and palytoxin. While tissues from 7 of 20 LST tested positive for brevetoxins, the levels were not considered to be in a range causing acute toxicosis. No known natural (algal blooms) or anthropogenic (pollutant spills) stressors co-occurred with the turtle mortality. While heavy metal toxicosis and organophosphate toxicosis were also investigated as possible causes, there was no evidence for their involvement. We speculate that the clinical signs and pathologic changes seen in the affected LST resulted from combined heavy spirorchiid parasitism and possible chronic exposure to a novel toxin present in the diet of LST.

Descriptors: subadult loggerhead sea turtles, *Caretta caretta*, nervous system diseases, trematoda infections, turtles, brain parasitology, marine toxins, heavy metals.

Jakes, K.A., P.J. O'Donoghue, and J. Whittier (2003). **Ultrastructure of *Hepatozoon boigae* (Mackerras, 1961) nov. comb. from brown tree snakes, *Boiga irregularis*, from northern Australia.** *Parasitology Research* 90(3): 225-231. ISSN: 0932-0113.

NAL Call Number: QL757.P377

Abstract: Intraerythrocytic bodies identified as haemogregarine gamonts were found in 29% of 97 brown tree snakes (*Boiga irregularis*) examined during a haematological survey of reptiles in Australasia during 1994-1998. The morphological characteristics of the parasites were consistent with those of *Haemogregarina boigae* Mackerras, 1961, although the gamonts were slightly larger and lacked red caps but contained distinctive polar grey capsules. Gamonts did not distend host cells but laterally displaced their nuclei. They were contained within parasitophorous vacuoles and possessed typical apicomplexan organelles, including a conoid, polar rings, rhoptries and micronemes. Schizonts producing up to 30 merozoites were detected in endothelial cells of the lungs of 11 snakes. The absence of erythrocytic schizogony suggests the parasites belong to the genus Hepatozoon. Electron microscopy also revealed the presence of curious encapsulated organisms in degenerating erythrocytes. These stages did not possess apical complex organelles and were surrounded by thick walls containing circumferential junctions and interposed strips reminiscent of oocyst sutures.

Descriptors: reptiles, brown tree snakes, *Boiga irregularis*, parasites, coccidiosis, eucoccidiida ultrastructure, erythrocytes ultrastructure, *Hepatozoon boigae* ultrastructure, Australia.

Jimenez Ruiz, F.A., L. Garcia Prieto, and G. Perez Ponce de Leon (2002). **Helminth infracommunity structure of the sympatric garter snakes *Thamnophis eques* and *Thamnophis melanogaster* from the Mesa Central of Mexico.** *Journal of Parasitology* 88(3): 454-460. ISSN: 0022-3395.

NAL Call Number: 448.8 J824

Abstract: Seventy-two Mexican garter snakes (*Thamnophis eques*) and 126 black-bellied garter snakes (*T. melanogaster*) were collected from 4 localities of the Mesa Central of Mexico between July 1996 and February 1998 and examined for helminths. Both species of garter snakes occurred sympatrically in every locality except in Lake Cuitzeo. Both species of

snakes shared 9 helminth species, and in general, *T. melanogaster* hosted a larger number of species than *T. eques*. In each locality, a different helminth species showed the highest levels of prevalence and abundance (*Spiroxys susanae* in Cienaga de Lerma, *Telorchis corti* in Lago de Patzcuaro, *Proteocephalus variabilis* in Lago de Cuitzeo, and *Contracaecum sp*. in Lago de Chapala). Helminth communities in garter snakes of the Mesa Central are depauperate and dominated by a single parasite species. In those localities where the snakes occurred in sympatry, helminth communities were, in general, more diverse and species-rich in *T. melanogaster*. Differences in the ecology and physiology of these species of garter snakes may explain this pattern because black-bellied garter snakes (*T. melanogaster*) are more aquatic than Mexican garter snakes (*T. eques*) and primarily eat aquatic prey, potentially exposing themselves to a larger number of helminths transmitted by predator-prey infection. The helminth infracommunities of garter snakes in the Mesa Central of Mexico show a strong Nearctic influence because most of the species infecting these hosts have been recorded in other Nearctic colubrid snakes. However, the helminth infracommunities of these garter snakes are less species-rich and less diverse than those in colubrid snakes in more temperate latitudes. The widespread ecological perturbation of sampling sites in the Mesa Central because of human activity, and geographic differences in foraging ecology of the hosts and, thus, exposure to parasites transmitted by intermediate hosts may help to explain these patterns.
Descriptors: reptiles, sympatric garter snakes, Mexican garter snakes, black bellied garter snakes, preditor-prey infection, Helminths, Mexico.

Jones, H.I. (2003). **Parasitic worms in reptiles from Tasmania and the islands of Bass Strait.** *Papers and Proceedings of the Royal Society of Tasmania* 137: 7-12. ISSN: 0080-4703.
Descriptors: reptiles, parasitic worms, endoparasitic worms, nematodes, Tasmania, Bass Straight islands.

Jovani, R., L. Amo, E. Arriero, O. Krone, A. Marzal, P. Shurulinkov, G. Tomas, D. Sol, J. Hagen, P. Lopez, J. Martin, C. Navarro, and J. Torres (2004). **Double gametocyte infections in apicomplexan parasites of birds and reptiles.** *Parasitology Research* 94(2): 155-157. ISSN: 0932-0113.
NAL Call Number: QL757.P377
Descriptors: reptiles, birds, apicomplexan parasites, double gametocyte infections, male, female, blood cell.

Junker, K., O. Bain, and J. Boomker (2006). ***Eustrongylides* sp (Nematoda : Dioctophymatoidea) from the stomach of a Nile crocodile, *Crocodylus niloticus laurenti*, 1768, in Botswana**. *Onderstepoort Journal of Veterinary Research* 73(4): 315-317. ISSN: 0030-2465.
NAL Call Number: 41.8 On1
Descriptors: reptiles, Nile crocodile, Nematoda, *Eustrongylides* sp., stomach, Botswana.

Junker, K., K. Wallace, A.J. Leslie, and J. Boomker (2006). **Gastric nematodes of Nile crocodiles, *Crocodylus niloticus* Laurenti, 1768, in the Okavango River, Botswana.** *Onderstepoort Journal of Veterinary Research.* 73(2): 111-114. ISSN: 0030-2465.

NAL Call Number: 41.8 On1
Abstract: The ascaridoid nematodes *Dujardinascaris madagascariensis* Chabaud & Caballero, 1966, *Dujardinascaris dujardini* (Travassos, 1920), *Gedoelstascaris vandenbrandeni* (Baylis, 1929) Sprent, 1978 and *Multicaecum agile* (Wedl, 1861) Baylis, 1923 were recovered from the stomach contents of *Crocodylus niloticus* Laurenti, 1768 from the Okavango River, Botswana, together with *Eustrongylides* sp., a dioctophymatoid nematode usually parasitizing piscivorous birds. *Dujardinascaris madagascariensis* was present in most of the infected hosts, while the remaining species were mostly represented in single collections in one to three hosts. All four ascaridoid nematodes represent new geographic records.
Descriptors: alligators and crocodiles parasitology, nematoda isolation, purification, nematode infections veterinary, stomach diseases, epidemiology, classification, infections epidemiology, nematode infections parasitology, phylogeny, prevalence, species specificity, stomach parasitology, stomach diseases epidemiology, stomach diseases, Botswana.

Kenny, M.J., S.E. Shaw, P.D. Hillyard, and A.B. Forbes (2004). **Ectoparasite and haemoparasite risks associated with imported exotic reptiles.** *Veterinary Record* 154(14): 434-435. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, exotic, imported, risks, ectoparasites, hemoparasites, transmission.

Khan, A., N. Khatoon, and F.M. Bilqees (2002). ***Centrorhynchus sindhensis*, new species (Acanthocephala: Centrorhynchinae) from the snake (*Naja naja*) intestine.** *Pakistan Journal of Zoology* 34(4): 309-310. ISSN: 0030-9923.
NAL Call Number: QL1.P3
Descriptors: reptiles, snake, intestinal parasite, parasites, new species, Acanthocephala, snake, intestine, Pakistan.

Kuzmin, Y., V.V. Tkach, and S.D. Snyder (2003). **The nematode genus *Rhabdias* (Nematoda: Rhabdiasidae) from amphibians and reptiles of the Nearctic**. *Comparative Parasitology* 70(2): 101-114. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Abstract: Data on the representatives of the nematode family Rhabdiasidae in the Nearctic are summarized from the literature, examination of museum specimens and study of new material collected from amphibians and reptiles in Arkansas, Mississippi, Nebraska, Tennessee and Wisconsin, USA, during 1999-2002. A description of *Rhabdias tarichae* sp. nov. and redescriptions of *R. joaquinensis, R. ambystomae, R. ranae* and *R. americanus* are given. New host and geographical records are provided for several *Rhabdias species. Rhabdias* sp., probably representing another species new to science, was found among museum specimens from the California newt *Taricha torosa;* however, the poor state of the specimens did not permit description. Keys for determination of Nearctic *Rhabdias* species are provided, and the applicability of some morphological characteristics for differentiation of *Rhabdias* species is discussed. *Courtesty of CAB Abstracts.*
Descriptors: reptiles, Nematode, genus *Rhabdias*, Nearctic, amphibians.

Kuzmin, Y. (2003). ***Rhabdias japalurae sp*. Nov. (Nematoda, rhabdiasidae) from the japalures (reptilia, agamidae) and some notes on other *Rhabdias* spp. From lizards.** *Acta Parasitologica* 48(1): 6-11. ISSN: 1230-2821.
NAL Call Number: QL757.A27
Descriptors: reptiles, parasites, *Rhabdias japalurae*, nematoda, japalures, notes.

Lai, C.H., Y.C. Kuo, K.C. Tung, and J.S. Wang (2004). **A survey of endoparasitic infections of snakes in Taiwan.** *Taiwan Veterinary Journal* 30(1): 26-32. ISSN: 1682-6485.
NAL Call Number: SF604.C54
Descriptors: reptiles, snakes, endoparasites, survey, cestodes, digenea, nematodes, pentastomida, Taiwan.
Language of Text: Chinese; Summary in Chinese and English.

Lainson, R. (2005). **The genus *Cyclospora* (Apicomplexa: Eimeriidae), with a description of *Cyclospora schneideri* n.sp. in the snake *Anilius scytale scytale* (Aniliidae) from Amazonian Brazil--a review.** *Memorias Do Instituto Oswaldo Cruz* 100(2): 103-110. ISSN: 0074-0276.
Online: http://dx.doi.org/10.1590/S0074-02762005000200001
Abstract: A review is made of the recorded species of the coccidian genus *Cyclospora* and major events leading up to the discovery of *C. cayetanensis*, which is responsible for serious outbreaks of diarrhoea in man and is one of the aetiological agents of "traveller's diarrhoea". Humans appear to be the specific hosts, with the entire life-cycle in the intestine: to date there is no convincing evidence that the disease is a zoonosis. A description is given of oocysts and endogenous stages of *C. schneideri* n.sp., in the snake *Anilius scytale scytale*. Sporulation is exogenous and completed after about one week at 24-26 degrees. Mature oocysts 19.8 x 16.6 (15.1 x 13.8-25.7 x 20.1), shape-index 1.2 (1.0-1.3): no oocyst residuum or polar bodies. Oocyst wall a single colourless, smooth layer with no micropyle: it is rapidly deformed or broken. Sporocysts 13.6 x 9.4 (11.3 x 8.3-15.1 x 9.9), shape-index 1.4 (1.2-1.5) with an inconspicuous Stieda body. Sporozoites 11-13 x 2.5-3. Endogenous stages are intracytoplasmic in the epithelial cells of the small intestine and with the characters of the Eimeriorina.
Descriptors: snakes, *Cyclospora* classification, cytoplasm parasitology, small intestine, parasitology, oocysts isolation, purification, *Cyclospora* growth, development, review, Brazil.

Lainson, R. (2002). **Intestinal coccidia (Apicomplexa: Eimeriidae) of Brazilian lizards. *Eimeria carmelinoi n*.sp., from *Kentropyx calcarata* and *Acroeimeria paraensis n*.sp. from *Cnemidophorus lemniscatus lemniscatus* (Lacertilia: Teiidae).** *Memorias Do Instituto Oswaldo Cruz* 97(2): 227-237. ISSN: 1678-8060.
Online: http://dx.doi.org/10.1590/S0074-02762002000200016
Abstract: *Eimeria carmelinoi n*.sp., is described in the teiid lizard *Kentropyx calcarata Spix*, 1825 from north Brazil. Oocysts subspherical to spherical, averaging 21.25 x 20.15 micro m. Oocyst wall smooth, colourless and devoid of striae or micropyle. No polar body or conspicuous oocystic residuum, but frequently a small number of fine granules in Brownian movement. Sporocysts, averaging 10.1 x 9 microm, are without a Stieda body. Endogenous

stages characteristic of the genus: intra-cytoplasmic, within the epithelial cells of the ileum and above the host cell nucleus. A re-description is given of a parasite previously described as *Eimeria cnemidophori,* in the teiid lizard *Cnemidophorus lemniscatus lemniscatus*. A study of the endogenous stages in the ileum necessitates renaming this coccidian as *Acroeimeria cnemidophori* (Carini, 1941) nov.comb., and suggests that *Acroeimeria pintoi* Lainson & Paperna, 1999 in the teiid *Ameiva ameiva* is a synonym of *A. cnemidophori*. A further intestinal coccidian, *Acroeimeria paraensis n*.sp. is described in *C. l. lemniscatus*, frequently as a mixed infection with *A. cnemidophori*. Mature oocysts, averaging 24.4 x 21.8 microm, have a single-layered, smooth, colourless wall with no micropyle or striae. No polar body, but the frequent presence of a small number of fine granules exhibiting Brownian movements. Sporocysts 9 x 8, without a Stieda body. Endogenous stages epicytoplasmic, characteristic of the genus, in the upper ileum. The importance of a study of the endogenous stages of eimeriid coccidia is discussed.

Descriptors: reptiles, lizards, intestinal coccidia, oocysts, sporocysts, *Eimeria*, ileum, Brazil.

Lainson, R., M.C. de Souza, and C.M. Franco (2003). **Haematozoan parasites of the lizard *Ameiva ameiva* (Teiidae) from Amazonian Brazil: A preliminary note.** *Memorias Do Instituto Oswaldo Cruz* 98(8): 1067-1070. ISSN: 1678-8060.

Online: http://dx.doi.org/10.1590/S0074-02762003000800016

Abstract: Three different haematozoan parasites are described in the blood of the teiid lizard *Ameiva ameiva* Linn. from North Brazil: one in the monocytes and the other two in erythrocytes. The leucocytic parasite is probably a species of *Lainsonia Landau*, 1973 (Lankesterellidae) as suggested by the presence of sporogonic stages in the internal organs, morphology of the blood forms (sporozoites), and their survival and accumulation in macrophages of the liver. One of the erythrocytic parasites produces encapsulated, stain-resistant forms in the peripheral blood, very similar to gametocytes of *Hemolivia Petit* et al., 1990. The other is morphologically very different and characteristically adheres to the host-cell nucleus. None of the parasites underwent development in the mosquitoes *Culex quinquefasciatus* and *Aedes aegypti* and their behaviour in other haematophagous hosts is under investigation. Mixed infections of the parasites commonly occur and this often creates difficulties in relating the tissue stages in the internal organs to the forms seen in the blood. Concomitant infections with a *Plasmodium tropiduri*-like malaria parasite were seen and were sometimes extremely heavy.

Descriptors: reptiles, lizard, *Ameiva ameiva*, Hematozoan parasites, monocytes, erythrocytes, blood, leucocytic parasite, sporozoites, macrophages, liver.

Lainson, R. (2003). **Some coccidial parasites of the lizard *Amphisbaena alba* (Reptilia: Amphisbaenia: Amphisbaenidae).** *Memorias Do Instituto Oswaldo Cruz* 98(7): 927-936. ISSN: 0074-0276.

Online: http://dx.doi.org/10.1590/S0074-02762003000700012

Descriptors: reptiles, lizard, *Amphisbaena alba*, coccidial parasites, feces, oocyst, stained kidney smear.

Lainson, R., I. Paperna, and R.D. Naiff (2003). **Development of *Hepatozoon caimani* (Carini, 1909) pessoa, de biasi & de souza, 1972 in the *Caiman caiman* c. Crocodilus, the frog *Rana catesbeiana* and the mosquito *Culex fatigans*.** *Memorias Do Instituto Oswaldo Cruz* 98(1): 103-113. ISSN: 0074-0276.
Online: http://dx.doi.org/10.1590/S0074-02762003000100014
Descriptors: amphibians, reptiles, frog, Rana, Crocodile, Caiman, mosquito, parasite, gametocytes, blood, cysts, *Hepatozoon caimani.*

Leinwand, I., A.M. Kilpatrick, N. Cole, C.G. Jones, and P. Daszak (2005). **Patterns of coccidial prevalence in lizards of Mauritius.** *Journal of Parasitology.* 91(5): 1103-1108. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: This paper reports prevalence of coccidial oocysts in fecal samples from 6 endemic and 2 introduced lizard species on Mauritius, an island nation in the Indian Ocean. Total coccidian prevalence was 54% (n = 341) for the endemic 'ornate day gecko,' *Phelsuma ornata*; 48% (n = 159) for the endemic 'Durrell's night gecko,' *Nactus durrelli*; 53% (n = 15) for the endemic 'Serpent Island night gecko,' *N. serpensinsula*; and 78% (n = 248) for the introduced gecko, *Hemidactylus frenatus* . These high prevalences may reflect lack of long-lasting immune response to coccidial infection. There were few significant differences in prevalence among age, island, sex, or body condition within species, suggesting that these coccidia are relatively nonpathogenic and have little effect on host fitness. Prevalence was higher in the dry season than the wet season. These data suggest other factors, such as low host immune response to reinfection, affect overall prevalence more significantly than the effect of humidity on oocyst survival on Mauritius. No coccidia were found in samples from the endemic 'Gunner's Quoin night gecko,' *N. coindemirensis* (n = 155), probably reflecting parasite extinction due to a host population bottleneck following historical introduction of rats. There was no evidence of competitive or facilitative interactions between *Eimeria* sp. and *Isospora* sp., but evidence of competition between 2 *Eimeria* species in the 'ornate day gecko,' *Phelsuma ornata*. No evidence was found of cross-species infection, suggesting that reptile coccidia have high host specificity and are, therefore, poor subjects for studies of parasite-mediated competition and the evolution of sex.
Descriptors: lizards, coccidiosis, veterinary, parasitology, epidemiology, feces, Mauritius, oocysts, prevalence, patterns, gecko.

Loukopoulos, P., A. Komnenou, E. Papadopoulos, and V. Psychas (2007). **Lethal *Ozolaimus megatyphlon* infection in a green iguana (*Iguana iguana rhinolopa*).** *Journal of Zoo and Wildlife Medicine* 38(1): 131-134. ISSN: 1042-7260.
Abstract: An imported 2.5-yr-old female green iguana (*Iguana iguana rhinolopa*) kept in Greece was presented with a history of anorexia and allotriophagy of 1 mo duration. Upon clinical examination, it was cachectic and had severe abdominal distension and fibrous osteodystrophy. Despite treatment, it died a month later. On necropsy, massive accumulations of threadlike nematode parasites were observed in the large intestine, identified as *Ozolaimus megatyphlon,* a member of the Oxyuridae family of Pharyngodonidae, a usually nonpathogenic intestinal parasite of iguanas. To the authors' knowledge, its presence has not been

reported previously in Europe, although one pathogenic infection has been reported previously in Japan. The animal was presumably infected before importation. Although death was attributed to the heavy parasitic overload, the poor diet and terrarium hygiene, and absence of an anthelminthic regime further contributed to the deterioration of the animal's condition. Recognition of this condition, which may be recently introduced or underdiagnosed, may help improve medical and trade standards concerning this species in practice.
Descriptors: reptiles, green iguana, infection, nematode, parasites, abdominal distension, fibrous osteodystrophy.

Martin, J.E. and V. Roca (2004). **Helminth infracommunities of a population of the Gran Canaria giant lizard *Gallotia stehlini*.** *Journal of Helminthology* 78(4): 319-322. ISSN: 0022-149X.
NAL Call Number: 436.8 J82
Abstract: A survey of gastro-intestinal helminth communities of *Gallotia stehlini* (Sauria: Lacertidae) from Gran Canaria island (Canary Archipelago, Spain), was conducted to determine the prevalence, abundance and species diversity of intestinal parasites in these lizards. Pharyngodonid nematodes were the most common intestinal helminths, three species being Gallotia specialists. Helminth infracommunities of *G. stehlini* were rich and appear to be closer to the interactive end of the continuum isolationist-interactive helminth communities, according to the high values of helminth diversity. It is the first case of a saurian reptile showing this kind of diverse helminth infracommunity, produced by a large size, a wide-ranging plant diet and exposure to helminths with direct life-cycles.
Descriptors: reptiles, Gran Canaria giant lizard, *Gallotia stehlini*, helminth infracommunities, gastrointestinal, nematodes, intestinal, Canary Archipelago, Spain.

McAllister, C.T., J.E. Cordes, and J.M. Walker (2003). **Helminth parasites of unisexual and bisexual whiptail lizards (Teiidae) in North America. X. the western marbled whiptail (*Cnemidophorus tigris marmoratus*)**. *Texas Journal of Science* 55(4): 307-314. ISSN: 0040-4403.
NAL Call Number: 470 T31
Descriptors: reptiles, lizards, Teiidae, marbled whiptail, *Cnemidophorus tigris marmoratus*, helminth parasites, unisexual, bisexual, North America.

Mcallister, C.T. and C.R. Bursey (2007). **Some nematode and acanthocephalan parasites of the longnose leopard lizard, *Gambelia wislizenii* (Lacertilia : Crotaphytidae), from Arizona, California, and Texas, with a summary of the helminths reported from this host**. *Comparative Parasitology* 74(1): 179-184. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: reptiles, longnose leopard lizard, *Gambelia wislizenii*, nematode, acanthocephalan, helminths, Arizona, California, Texas, summary.

McKenna, P.B. (2003). **An annotated checklist of ecto- and endoparasites of New Zealand reptiles**. *Surveillance Wellington* 30(3): 18-25. ISSN: 0112-4927.
Descriptors: reptiles, nematodes, ectoparasites, helminths, Acari, Cestoda, Nematoda, Protozoa, Sauria, Trematoda, hosts, checklist, New Zealand.

Menezes, V.A., D. Vrcibradic, J.J. Vicente, G.F. Dutra, and C.F. Rocha (2004). **Helminths infecting the parthenogenetic whiptail lizard *Cnemidophorus nativo* in a restinga habitat of Bahia State, Brazil.** *Journal of Helminthology* 78(4): 323-328. ISSN: 0022-149X.
NAL Call Number: 436.8 J82
Abstract: A sample of 101 specimens of the unisexual whiptail lizard *Cnemidophorus nativo* (Squamata; Teiidae) from a coastal site in Bahia State, Brazil were examined for the presence of endoparasites. Of these, 35 (34.7%) harboured helminths. Six helminth species were recovered from *C. nativo*, including five nematodes (*Physaloptera retusa, Physalopteroides venancioi, Subulura lacertilia, Skrjabinelazia intermedi*a and *Parapharyngodon sp*., and one cestode (*Oochoristica ameivae*), all representing new host records. Most lizards were infected by a single species of helminth and none by more than three. Infection rates were neither significantly influenced by host body size nor by environmental factors. The results are compared with data from studies on other whiptail species in both South and North America.
Descriptors: reptiles, whiptail lizard, *Cnemidophorus nativo*, Helminths, endoparasites, nematodes, cestode, infection rates, Bahia State, Brazil.

Merchant, M., D. Thibodeaux, K. Loubser, and R.M. Elsey (2004). **Amoebacidal effects of serum from the American alligator (*Alligator mississippiensis*).** *Journal of Parasitology* 90(6): 1480-1483. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Descriptors: reptiles, American alligator, *Alligator mississippiensis*, serum, effects, amoebacidal.

Mihalca, A.D., P. Fictum, M. Skoric, M. Sloboda, S. Karvemo, I. Ghira, M. Carlsson, and D. Modry (2007). **Severe granulomatous lesions in several Organs from Eustrongylides larvae in a free-ranging dice snake, *Natrix tessellata*.** *Veterinary Pathology* 44(1): 103-105. ISSN: 0300-9858.
Online: http://www.vetpathology.org/cgi/content/abstract/44/1/103
NAL Call Number: 41.8 P27
Abstract: During an extensive study regarding the epidemiology of larval Eustrongylides infestation in a free-ranging endangered population of dice snakes () from Histria, Romania, an adult female was euthanized to evaluate pathologic changes. Parasites appeared as nodules at various locations: in subcutaneous connective tissues, on the serosae of the intestines and liver. Histologic sections revealed nematode larvae surrounded by a capsule, forming a parasitic granuloma with 3 layers: macrophage layer, lymphocyte layer, and fibrous capsule. Differences between newly formed and mature granulomas consisted mainly in the eosinophilic infiltration. Other types of parasitic granulomas of reptiles are discussed in comparison with our findings.

Descriptors: reptiles, Colubridae, snakes, *Natrix tessellata*, Eustrongylides, nematode infections, nematode larvae, lesions (animal), granuloma, histopathology, parasitic granuloma.

Moco, T.C., L.H. O'Dwyer, F.C. Vilela, T.H. Barrella, and R.J. da Silva (2002). **Morphologic and morphometric analysis of *Hepatozoon* spp. (Apicomplexa, Hepatozoidae) of snakes.** *Memorias Do Instituto Oswaldo Cruz* 97(8): 1169-1176. ISSN: 1678-8060.
Online: http://dx.doi.org/10.1590/S0074-02762002000800019
Abstract: *Hepatozoon* species are the most abundant hemoparasites of snakes. Its identification has been based mainly on the morphologic characterization of the gamonts in the peripheral blood of the vertebrate host and also of the cysts found in the internal organs of the vertebrate and invertebrate hosts. Using a computerized image analysis system, we studied five species of *Hepatozoon* from recently captured snakes in Botucatu, State of S o Paulo, Brazil, to evaluate the importance of the morphology and morphometry of the gamonts for the characterization of *Hepatozoon* species and to analyze the morphologic changes induced in the erythrocytes by the parasite. The studied species were *H. terzii* of *Boa constrictor amarali*, *Hepatozoon* sp. of *Crotalus durissusterrificus*, *H. philodryasi* of *Philodryas patagoniensis*, and *H. migonei* and *H. cyclagrasi* of *Hydrodynastes gigas*. We observed three different groups, one of them including the species *H. terzii, H. philodryasi* and *Hepatozoon* sp. of *C. durissus terrificus*; and the other two consisting of *H. migonei* and *H. cyclagrasi*. Degree of alterations in the erythrocytes was variable and it may be useful for characterization of *Hepatozoon* species.
Descriptors: reptiles, snakes, parasites, *Hepatozoon*, species peripheral blood, gamonts computerized image analysis, characterization, Brazil.

Modry, D., J.R. Slapeta, and B. Koudela (2005). **Mice serve as paratenic hosts for the transmission of *Caryospora duszynskii* (Apicomplexa: Eimeriidae) between snakes of the genus *Elaphe*.** *Folia Parasitologica* 52(3): 205-208. ISSN: 0015-5683.
NAL Call Number: 436.8 C33
Abstract: *Caryospora duszynskii Upton*, Current et Barnard, 1984 was successfully transmitted to snakes of the genus *Elaphe* by feeding them previously infected mice. Fifty thousand oocysts were orally administered to two mouse strains, BALB/c and Crl:CD-1(ICR)BR, which were subsequently fed to captive-born coccidia-free *Elaphe guttata* (L.) in two respective independent experiments. Both *E. guttata* expelled *C. duszynskii* oocysts in their faeces, beginning on day 18 and 26 post infection (p.i.) and shed oocysts continuously through the end of the experiment, day 230 and 135 p.i., respectively. There were no parasitic stages or lesions in mice, as revealed by histological examination. Experiments proved that rodents serve as paratenic hosts for *C. duszynskii*. In summary we discuss the life-cycle strategies of *Caryospora* spp. in reptiles and present three general modes of their development.
Descriptors: snakes, mice, coccidiosis, life cycle stages, physiology, rodent diseases parasitology, rodent diseases transmission, snakes parasitology, coccidiosis transmission, feces parasitology, host parasite relations, oocysts.

Moravec, F. and M.D. Little (2004). **Redescription of *Dracunculus globocephalus* Mackin, 1927 (Nematoda: Dracunculidae), a parasite of the snapping turtle, *Chelydra serpentina.*** *Folia Parasitologica* 51(4): 339-345. ISSN: 0015-5683.
NAL Call Number: 436.8 C33
Abstract: *Dracunculus globocephalus* Mackin, 1927 (Nematoda: Dracunculoidea) is redescribed from specimens collected from the mesentery of the snapping turtle, *Chelydra serpentina* (L.), in Louisiana, USA. The use of scanning electron microscopy, applied for the first time in this species, made it possible to study details in the structure of the cephalic end and the arrangement of male caudal papillae that are difficult to observe under the light microscope. This species markedly differs from all other species of Dracunculus in having the spicules greatly unequal in size and shape, in the absence of a gubernaculum, and in the disposition of male caudal papillae. The validity of *D. globocephalus* is confirmed, but the above mentioned morphological differences are not sufficient for listing it in a separate genus. This is the first record of *D. globocephalus* in Louisiana.
Descriptors: reptiles, snapping turtle, *Chelydra serpentina*, Nematoda, *Dracunculus globocephalus*, parasite, redescribed.

Murray, R.A., N.O. Dronen, and C.K. Blend (2004). **Endohelminths from the black marsh turtle, *Siebenrockiella crassicollis*, confiscated by international authorities in Hong Kong, People's Republic of China**. *Comparative Parasitology* 71(2): 255-257. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: reptiles, helminths, black marsh turtle, *Siebenrockiella crassicollis*, endohelminths, confiscated, Hong Kong.

O'Grady, S.P., M. Morando, L. Avila, and M.D. Dearing (2005). **Correlating diet and digestive tract specialization: examples from the lizard family Liolaemidae.** *Zoology [Jena]* 108(3): 201-210. ISSN: 0944-2006.
NAL Call Number: QL1.Z769
Abstract: A range of digestive tract specializations were compared among dietary categories in the family Liolaemidae to test the hypothesis that herbivores require greater gut complexity to process plant matter. Additionally, the hypothesis that herbivory favors the evolution of larger body size was tested. Lastly, the association between diet and hindgut nematodes was explored. Herbivorous liolaemids were larger relative to omnivorous and insectivorous congeners and consequently had larger guts. In addition, small intestine length of herbivorous liolaemids was disproportionately longer than that of congeners. Significant interaction effects between diet and body size among organ dimensions indicate that increases in organ size occur to a greater extent in herbivores than other diet categories. For species with plant matter in their guts, there was a significant positive correlation between the percentage of plant matter consumed and small intestine length. Herbivorous liolaemids examined in this study lacked the gross morphological specializations (cecum and colonic valves) found in herbivores in the families Iguanidae and Agamidae. A significantly greater percentage of herbivorous species had nematodes in their gut. Of the species with nematodes, over 95% of herbivores had nematodes only in the hindgut. Prevalence of nematodes in the hindgut of herbivores was 2 x that of omnivores and 4 x that of insectivores.

Descriptors: lizards, diet, feeding behavior, gastrointestinal tract anatomy, nematoda, body size, body weights, gastrointestinal contents, gastrointestinal tract parasitology, Argentina.

Oprescu, I. (2004). **Bolile parazitare ale reptilelor si terapia lor. (Partea A II-A). [The parasitic diseases of reptiles and their treatment. (Part II)].** *Revista Romana De Medicina Veterinara* 14(1): 67-74. ISSN: 1220-3173.
Descriptors: reptiles, parasitic diseases, treatment, veterinary.
Language of Text: Romanian.

Oprescu, I. (2003). **Bolile parazitare ale reptilelor si terapia lor. [The parasitic diseases of reptiles and their treatment].** *Revista Romana De Medicina Veterinara* 13(2): 82-94. ISSN: 1220-3173.
Descriptors: reptiles, parasitic diseases, treatment, veterinary.
Language of Text: Romanian; Summary in English.

Peirce, M.A. and R.D. Adlard (2004). **Haemoparasites from clinical screening of reptiles in south-east Queensland, Australia.** *Veterinary Record* 155(22): 708-709. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, Hemogregarina, Hepatozoon, clinical screening, hemoparasites, Queensland, Australia.

Platt, T.R. (2003). **Description of *Auriculotrema lechneri* n. gen., n. sp. (Digenea: Choanocotylidae), a parasite of freshwater turtles (Testudines: Pleurodira: Chelidae) from Queensland, Australia.** *Journal of Parasitology* 89(1): 141-144. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: *Auriculotrema lechneri* n. gen., n. sp. is described from the small intestine of *Emydura krefftii* and *Elseya latisternum* from northern Queensland, Australia. The new species strongly resembles species of Choanocotyle in body shape, ventral incision of the oral sucker, structure of the cirrus sac, and location of the genital pore. The distinctive taxonomic feature is the presence of 2 winglike projections extending beyond the lateral margins of the oral sucker, in contrast to the extremely large, expanded oral sucker diagnostic of Choanocotyle spp. *Auriculotrema n*. gen. is the second genus included in the formerly monotypic Choanocotylidae Jue Sue and Platt, 1998.
Descriptors: reptiles, freshwater turtles, small intestine, parasites, *Auriculotrema lechneri*, description, Australia.

Platt, T.R. and V.V. Tkach (2003). **Two new species of *Choanocotyle* Jue Sue and Platt, 1998 (Digenea: Choanocotylidae) from an Australian freshwater turtle (Testudines: Pleurodira: Chelidae).** *Journal of Parasitology* 89(1): 145-150. ISSN: 6022-3395.
NAL Call Number: 448.8 J824
Abstract: *Choanocotyle hobbsi n*. sp. and *Choanocotyle juesuei n*. sp. are described from the small intestine of the oblong turtle *Chelodina oblonga* from the vicinity of Perth, Western Australia. These are the third and fourth species referred to Choanocotyle. *Choanocotyle hobbsi* is most similar to *Choanocotyle nematoides* but differs in the size and shape of the oral

sucker and the absence of a median loop in the cirrus sac. *Choanocotyle juesuei* is most similar to *Choanocotyle elegans* but differs in the size of the oral sucker and other morphometric criteria. Comparative analysis of the sequences of different nuclear ribosomal deoxyribonucleic acid regions of *C. nematoides* and *C. hobbsi* has confirmed that they are closely related but distinct species.
Descriptors: reptiles, freshwater turtles, *Choanocotyle* sp., parasites, small intestine, two new species.

Platt, T.R. (2006). **First report of *Echinochasmus* sp. from the snapping turtle (*Chelydra serpentina L.*) from Reelfoot Lake, Tennessee, U.S.A.** *Comparative Parasitology* 73(2): 161-164. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: reptiles, snapping turtle, *Chelydra serpentina*, *Echinochasmus* species, trematodes.

Pozio, E., C.M. Foggin, T. Gelanew, G. Marucci, A. Hailu, P. Rossi, and M.A.G. Morales (2007). ***Trichinella zimbabwensis* in wild reptiles of Zimbabwe and Mozambique and farmed reptiles of Ethiopia.** *Veterinary Parasitology* 143(3-4): 305-310. ISSN: 0304-4017.
NAL Call Number: SF810.V4
Descriptors: reptiles, farmed and wild, *Trichinella zimbabwensis*, infection, Zimbabwe, Mozambique, Ethiopia.

Pozio, E., C.M. Foggin, G. Marucci, G. La Rosa, L. Sacchi, S. Corona, P. Rossi, and S. Mukaratirwa (2002). ***Trichinella zimbabwensis n*.sp. (Nematoda), a new non-encapsulated species from crocodiles (*Crocodylus niloticus*) in Zimbabwe also infecting mammals.** *International Journal for Parasitology* 32(14): 1787-1799. ISSN: 0020-7519.
NAL Call Number: QH547.I55
Abstract: Since 1995, *Trichinella* larvae have been detected in 39.5% of farmed crocodiles (*Crocodylus niloticus*) in Zimbabwe. Morphological, biological, biochemical and molecular studies carried out on one isolate from a farmed crocodile in 2001 support the conclusion that this parasite belongs to a new species, which has been named *Trichinella zimbabwensis n*.sp. This species, whose larvae are non-encapsulated in host muscles, infects both reptiles and mammals. The morphology of adults and larvae is similar to that of *Trichinella papuae*. Adults of *T. zimbabwensis* cross in both directions with adults of *T. papuae* (i.e. male of *T. zimbabwensis* per female of *T. papuae* and male of *T. papuae* per female of *T. zimbabwensis*), producing F1 offspring which produce very few and less viable F2 larvae. Muscle larvae of *T. zimbabwensis*, like those of *T. papuae*, do not infect birds. Three allozymes (of a total of 10) are diagnostic between *T. zimbabwensis* and *T. papuae*, and five are diagnostic between *T. zimbabwensis* and *Trichinella pseudospiralis*, the third non-encapsulated species. The percentage of the pairwise alignment identity between *T. zimbabwensis* and the other Trichinella species for the cytochrome oxidase subunit I gene, the large subunit ribosomal-DNA (mt-lsrDNA) gene and the expansion segment five, shows that *T. zimbabwensis* is more similar to the two non-encapsulated species *T. papuae* (91% for cytochrome oxidase I; 96% for mt-lsrDNA; and 88% for expansion segment five) and *T. pseudospiralis* (88% for cytochrome

oxidase I; 90% for mt-lsrDNA; and 66-73% for expansion segment five) than to any of the encapsulated species (85-86% for cytochrome oxidase I; 88-89% for mt-lsrDNA; and 71-79% for expansion segment five). This is the first non-encapsulated species discovered in Africa. The finding of a new *Trichinella* species that infects both reptiles and mammals suggests that the origin of *Trichinella* parasites dates back further than previously believed and can contribute to understanding the phylogeny and the epidemiology of the genus *Trichinella*.

Descriptors: reptiles, alligators, crocodiles, *Trichinella* isolation, purification, helminth, intestines, polymerase chain reaction methods, trichinella classification, *Trichinella* genetics, *Trichinella* ultrastructure, trichinosis parasitology.

Pozio, E., G. Marucci, A. Casulli, L. Sacchi, S. Mukaratirwa, C.M. Foggin, and G. La Rosa (2004). ***Trichinella papuae* and *Trichinella zimbabwensis* induce infection in experimentally infected varans, caimans, pythons and turtles.** *Parasitology* 128(Pt 3): 333-342. ISSN: 0031-1820.

NAL Call Number: 448.8 P21

Abstract: The discovery of *Trichinella zimbabwensis* in farm crocodiles of Zimbabwe has opened up a new frontier in the epidemiology of the *Trichinella* genus. The objective of the present study was to investigate the infectivity of encapsulated species (*T. spiralis, T. nativa, T. britovi, T. murrelli* and *T. nelsoni*) and non-encapsulated species (*T. pseudospiralis, T. papuae* and *T. zimbabwensis*) in caimans (*Caiman crocodilus*), varans (*Varanus exanthematicus*), pythons (*Python molurus bivittatus*) and turtles (*Pelomedusa subrufa*) raised at their natural temperature range (26-32 degrees C). Mice and chickens were used as controls. At 6 days post-infection (p.i.), adult worms were detected in the small intestine of reptiles infected with *T. papuae* and *T. zimbabwensis*, of chickens infected with *T. pseudospiralis* and of mice infected with all encapsulated and non-encapsulated species. At 60 days p.i., *T. papuae* and *T. zimbabwensis* adult worms were collected from the intestine of varans and caimans and larvae from muscles of the four reptile species, *T. pseudospiralis* larvae from muscles of chickens, and larvae of all *Trichinella* species from mouse muscles. The highest reproductive capacity index of both *T. papuae* and *T. zimbabwensis* was observed in varans. The results show that *T. papuae* and *T. zimbabwensis* are able to complete their entire life-cycle in both poikilothermic and homoiothermic animals.

Descriptors: reptiles, varans, caimans, pythons, turtles, *Trichinella*, induced infection, animals, poikilothermics, homoiothermics.

Pozio, E., I.L. Owen, G. Marucci, and G. La Rosa (2005). **Inappropriate feeding practice favors the transmission of *Trichinella papuae* from wild pigs to saltwater crocodiles in Papua New Guinea.** *Veterinary Parasitology* 127(3-4): 245-251. ISSN: 0304-4017.

NAL Call Number: SF810.V4

Abstract: The recent discovery of *Trichinella zimbabwensis* in farmed crocodiles (*Crocodilus niloticus*) of Zimbabwe and its ability to infect mammals, and the development of both *T. zimbabwensis* and *Trichinella papuae* in experimentally infected reptiles led to an investigation of *Trichinella* infection in saltwater crocodiles (*Crocodylus porosus*) and in wild pigs (*Sus scrofa*) of Papua New Guinea, to see if *T. papuae* also, is present in both cold- and warm-

blooded animals. Of 222 crocodiles examined, 47 animals (21.2%), all from Kikori, Gulf Province, were positive for non-encapsulated larvae in the muscles. The greatest number of larvae was found usually in the biceps, with an average of 7 larvae/g. One isolate from a crocodile infected successfully both laboratory rats and mice. Of 81 wild pigs examined, 9 from Bensbach river area (Western Province) and 1 from Kikori area (Gulf Province) were positive for non-encapsulated larvae in the muscles. *Trichinella* larvae from both saltwater crocodiles and wild pigs have been identified by multiplex-PCR analysis as *T. papuae*. The sequence analysis of the region within the large subunit ribosomal DNA, known as the expansion segment V, has shown the presence of a molecular marker distinguishing *T. papuae* isolates of Bensbach river area from those of Kikori area. This marker could be useful to trace back the geographical origin of the infected animal. The epidemiological investigation carried out in the Kikori area has shown that local people catch young crocodiles in the wild and keep them in holding pens for several months, before sending them to the crocodile farm in Lae (Morobe Province). They feed the crocodiles primarily with wild pig meat bought at the local market and also with fish. These results stress the importance of using artificial digestion for routinely screening of swine and crocodiles, and of adopting measures for preventing the spread of infection, such as the proper disposal of carcasses and the adequate freezing of meat.

Descriptors: alligators, crocodiles, parasitology, animal feed, swine parasitology, trichinosis, animal husbandry, swine diseases, transmission, *Trichinella*, trichinosis transmission, feeding practices, inappropriate, Papua New Guinea.

Pozio, E., I.L. Owen, G. Marucci, and G. La Rosa (2004). ***Trichinella papuae* in saltwater crocodiles (*Crocodylus porosus*) of Papua New Guinea.** *Emerging Infectious Diseases* 10(8): 1507-1509. ISSN: print: 1080-6040; online: 1080-6059.

NAL Call Number: RA648.5.E46

Descriptors: reptiles, salt watercrocodiles, *Crocodylus porosus*, *Trichinella papuae*, infection , Papua New Guinea.

Ramallo, G., C.R. Bursey, and S.R. Goldberg (2002). ***Parapharyngodon riojensis n.* sp. (Nematoda: Pharyngodonidae) from the lizard *Phymaturus punae* (Squamata: Iguania: Liolaemidae) from northwestern Argentina.** *Journal of Parasitology.* 88(5): 979-982. ISSN: 0022-3395.

NAL Call Number: 448.8 J824

Abstract: Two hundred and forty-four specimens of *Parapharyngodon riojensis n*. sp. were found in the large intestines of 2 adult lizards *Phymaturus punae* collected from Quebrada del Leoncito, Province of La Rioja, Argentina. *Parapharyngodon riojensis n.* sp. represents the ninth species of the genus from the Neotropical Realm and the first species to be described from Argentina. It can be distinguished from all species of Parapharyngodon on the basis of the morphology of the anterior cloacal lip, the location of the ovary, and geographical distribution. *Parapharyngodon riojensis n*. sp. is most similar to *P. senisfaciecaudus* in that the ovary does coil around the esophagus and the number and location of caudal papillae in the males are the same. These 2 species differ in that the eggs of *P. senisfaciecaudus* are slightly asymmetrical, with a smooth, thin shell, whereas the eggs of *P. riojensis* are oval, with a punctate

thick shell. In addition, the cloacal lip of males of *P. senisfaciecaudus* is smooth, whereas the cloacal lip of males of *P. riojensis* is echinate. A key to the species of Parapharyngodon in the Neotropical Realm is provided.
Descriptors: reptiles, lizard, *Phymaturus punae*, Nematoda, description, esophagus, caudal papillae, Argentina.

Rashda, N.A., S.E. El Sebaii, and K.S. Al Khalifa (2006). **Studies on some biological aspects of *Culex pipiens* and *Culex quinquefasciatus* (Diptera: Culicidae) infected with *Hepatozoon* sp. harboured by the Saudian lizard *Uromastyx microlepis*.** *Journal of the Egyptian Society of Parasitology* 36(1): 251-258. ISSN: 0253-5890.
NAL Call Number: QL757.J65
Abstract: Laboratory observations revealed that both *C. pipiens* and *C. quinquefasciatus* could harbour the parasitic *Hepatozoon*, while only *Cx. pipiens* succeeded to induce infection to the recipient lizard *Uromastyx microlepis*. A significant reduction in egg production together with a significant increase in the pre-oviposition period of *C. pipiens* was recorded. Incubation period and percentage of egg hatching showed no significant changes. Infection had no effect on the reproductive fitness of *C. quinquefasciatus*. Haematin excretion was normally distributed for all both species. No size difference was recorded between infected and uninfected ones. Infection did not affect longevity.
Descriptors: reptiles, Saudian lizard, coccidiosis, culex, parasitology, *Hepatozoon* spp., biological aspects, parasite, harbor, infection.

Rashdan, N.A. and S.E. El Sebaii (2006). ***Culex neavei* Theobald, as a possible transmitter of *Hepatozoon matruhensis* to the Egyptian snake *Psammophis schokari*.** *Journal of the Egyptian Society of Parasitology* 36(1): 1-6, Following 6. ISSN: 0253-5890.
NAL Call Number: QL757.J65
Abstract: Stained smears of *Culex neavei* females infected with *Hepattozoon matruhensis* from *Psammophis schokari* and kept at 20 +/- 1 degrees C showed the complete developmental stages of the parasite. However, no detection of sporozoites was monitored when females were kept at 30 +/- 1 degrees C. A successful infection of *P. schokari* was carried out in the laboratory by *C. neavei* bites. The effect of infection on the mosquito longevity was insignificant ($p>0.05$) under low temperature and highly significant ($p<0.001$) under high temperature. The mortality rate was slightly affected at 20 +/- 1 degrees C, but greatly affected at 30 +/- 1 degrees C.
Descriptors: Egyptian snake, *Psammophis schokari*, coccidiosis veterinary, Colubridae parasitology, culex parasitology, eucoccidiida growth and development, insect vectors parasitology, coccidiosis parasitology, coccidiosis transmission, longevity, temperature, Egypt.

Reardon, J.T. and G. Norbury (2004). **Ectoparasite and hemoparasite infection in a diverse temperate lizard assemblage at Macraes Flat, South Island, New Zealand.** *Journal of Parasitology.* 90(6): 1274-1278. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: A lizard assemblage at Macraes Flat, New Zealand, comprising the common skinks *Oligosoma maccanni* and *Oligosoma nigriplantare polychroma*, the endangered species

Oligosoma grande and *Oligosoma otagense*, and the common gecko *Hoplodactylus maculatus*, was studied to determine the prevalence of ectoparasites and hemoparasites. The mites *Odontacarus lygosomae* and *Ophionyssus scincorum* infected all Oligosoma spp. only, and the mite *Neotrombicula naultini* infected only *H. maculatus*. The hemoparasite *Hepatozoon lygosomarum* infected all Oligosoma skinks, except *O. n. polychroma*. *Oligosoma otagense* had the highest infection levels of all parasites by several orders of magnitude. For all lizard species, there was no difference in mite prevalence between adult males and adult females, but juveniles were less often infected. For all skink species, there was a significant relationship between presence of the hemoparasite *He. lygosomarum* and infection intensity of the supposed vector, *O. scincorum*. It is unclear if patterns of parasite infection reflect species-specific susceptibility, host-parasite species-specific spatial ecology, or environmentally induced host physiological impairment. Considering the threatened nature of *O. otagense*, evidence of high parasitemia should stimulate further investigation.
Descriptors: reptiles, ectoparasites, hemoparasites, lizard, skinks, gecko, mites, New Zealand, Macraes Flat.

Robbins, R.G., B.D. Phong, T. McCormack, J.L. Behler, H.A. Zwartepoorte, D.B. Hendrie, and P.P. Calle (2006). **Four new host records for *Amblyomma geoemydae* (Cantor) (Acari: Ixodida: Ixodidae) from captive tortoises and freshwater turtles (Reptilia: Testudines) in the Turtle Conservation Center, Cuc Phuong National Park, Vietnam.** *Proceedings of the Entomological Society of Washington* 108(3): 726-729. ISSN: 0013-8797.
NAL Call Number: 420 W27
Descriptors: reptiles, tortoises, turtles, *Amblyomma geoemydae*, tick infestations, new host records, Testudines, wildlife management, Vietnam.

Salkeld, D.J. and L. Schwarzkopf (2005). **Epizootiology of blood parasites in an Australian lizard: a mark-recapture study of a natural population.** *International Journal for Parasitology* 35(1): 11-18. ISSN: 0020-7519.
NAL Call Number: QH547.I55
Abstract: The dynamics of a naturally endemic blood parasite (*Hepatozoon hinuliae*) were studied in a lizard (*Eulamprus quoyii*) host population, using 2 years of longitudinal data. We investigated how parasite abundance in the population varied over time, examined whether certain host sub-populations were more prone to infection, and compared parasite loads in relation to host reproductive behaviour. We recorded blood parasite infections of 331 individuals, obtained in 593 captures. Prevalence (the proportion of the host population infected) of blood parasites was high; approximately 66% of the lizard population was infected. Probability of infection increased with host age and size, but did not differ between the sexes. Within individuals, parasite load (the intensity of infection within individuals) did not vary over time, and was independent of host reproductive behaviour. Parasite load was significantly higher in males compared to females.
Descriptors: lizard, *Eulamprus quoyii*, blood parasites, *Hepatozoon hinuliae*, epizootiology, dynamics, host population, infection, parasite load, prevalence, reproductive behavior.

Santoro, M., J.A. Morales, B. Stacy, and E.C. Greiner (2007). ***Rameshwarotrema uterocrescens* trematode parasitism of the oesophageal glands in green sea turtles (*Chelonia mydas*).** *Veterinary Record* 160(2): 59-60. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, *Chelonia mydas*, green sea turtles, esophageal diseases, Digenea, (Trematoda), trematode parasitism.

Santoro, M., E.C. Greiner, J.A. Morales, and B. Rodriguez Ortiz (2006). **Digenetic trematode community in nesting green sea turtles (*Chelonia mydas*) from Tortuguero Nnational Park, Costa Rica**. *Journal of Parasitology* 92(6): 1202-1206. ISSN: 0022-3395.
Descriptors: reptiles, nesting green sea turtles, *Chelonia mydas*, digenetic trematode community, gastrointestinal, helminth community, Costa Rica.

Segade, P., C. Crespo, C. Ayres, A. Cordero, M.C. Arias, J.M. Garcia Estevez, and R. Iglesias Blanco (2006). ***Eimeria* species from the European pond turtle, *Emys orbicularis* (Reptilia: Testudines), in Galicia (NW Spain), with description of two new species.** *Journal of Parasitology.* 92(1): 69-72. ISSN: 0022-3395.
Abstract: Parasitological examination of feces from 44 *Emys orbicularis* from Galicia (NW Spain) revealed the presence of 2 new eimerian species, *Eimeria gallaeciaensis* sp. n. and *E. emydis* sp. n., as well as *E. mitraria* (Laveran and Mesnil, 1902) Doflein, 1909. Oocysts of *E. gallaeciaensis* n. sp. were found in 20 of 44 (45.4%) turtles and are subspherical to lightly ovoid-ellipsoid, 19.3 x 16.0 (17-22 x 15-18) microm, shape index 1.2 (1.1-1.3), with a smooth, single-layered wall. Micropyle and polar granule are absent, but an oocyst residuum is present. Sporocysts are ellipsoid, 9.7 x 5.1 (9-10 x 5-6) microm, shape index 1.9 (1.7-2.0), each with a sporocyst residuum and a conical Stieda body usually bearing 1-4 short and thin projections. Oocysts of *E. emydis* n. sp. were found in the feces of 5 of 44 (11.4%) turtles and are ovoid, rarely pear-shaped, 22.6 x 17.0 (20-25 x 15.5-18) microm, shape index 1.3 (1.2-1.5), with a smooth, single-layered wall with a slight thinning at the pointed end. Micropyle and polar granule are absent, and an oocyst residuum is present. Sporocysts are ellipsoid, 11.4 x 6.0 (9-13 x 5-7) microm, shape index 1.9 (1.6-2.2), each with sporocyst residuum and a prominent Stieda body bearing 3-5 club-shaped projections. In addition to the new species described, this is the first report of *E. mitraria* parasitizing *E. orbicularis.*
Descriptors: coccidiosis veterinary, turtles , *Eimeria* isolation and purification, parasitology, coccidiosis parasitology, Eimeria classification, eimeria ultrastructure, feces parasitology, oocysts isolation and purification, oocysts ultrastructure, Spain, sporozoites ultrastructure.

Seville, R.S., I.M. Asmundsson, and J.A. Campbell (2005). **Descriptions of six new species of *Caryospora* (Apicomplexa: Eimeriidae) from Guatemalan snakes (Serpentes: Colubridae and Viperidae).** *Journal of Parasitology.* 91(6): 1452-1458. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: One hundred and seventy snakes were collected in Guatemala and examined for coccidia. Of these, 8 individuals representing 6 host species were positive for Caryospora spp., 6 of which are described as new species. Sporulated oocysts of *Caryospora bothriechis* n. sp. from *Bothriechis aurifer* are spheroidal to subspheroidal, 12.7 x 12.5 (12-14 x 12-13)

microm, with a length/width (L/W) ratio of 1.0; they lack a micropyle (M) or oocyst residuum (OR), but 1 large polar granule (PG) is usually present. Sporocysts are ovoidal, 9.0-7.5 (8-10 x 7-8) microm, and have a L/W ratio of 1.2, and a Stieda body (SB) and sporocyst residuum (SR). Oocysts of *Caryospora coniophanis* n. sp. from *Coniophanes imperialis* are spheroidal to subspheroidal, 18.8 x 18.1 (17-20.5 x 16-20) microm, with a L/W ratio of 1.0; they lack a M and OR, but 1 large PG is usually present. Sporocysts are ovoidal, 13.2 x 9.4 (12-15 x 8-10) microm with a L/W ratio of 1.4, and a SB, substieda body (SSB), and SR. Oocysts of *Caryospora conophae* n. sp. from *Conophis lineatus* are spheroid to subspheroidal, 20.4 x 19.5 (17-26 x 17-25) microm, with a L/W ratio of 1.0; they lack a M and OR, but 1 large PG is usually present. Sporocysts are ovoidal, 13.1 x 9.8 (11-15 x 8-11) microm with a L/W ratio of 1.3 and a SB, SSB, and SR. Oocysts of *Caryospora guatemalensis* n. sp. from *Lampropeltis triangulum* are spheroidal to subspheroidal, 23.9 x 23.2 (20-27 x 20-26) microm, with a L/W ratio of 1.0; they lack a M and OR, but 1 large PG is usually present. Sporocysts are ovoidal, 14.4 x 10.6 (13-18 x 9-13) microm, with a L/W ratio of 1.4 and a SB, SSB, and SR. Oocysts of *Caryospora mayorum* n. sp. from *Conophis lineatus* are spheroidal to subspheroidal, 25.6 x 24.4 (24-27 x 24-25) microm, with a L/W ratio of 1.0; they lack a M and OR, but 1 large PG is usually present. Sporocysts are ovoidal, 16.3 x 11.9 (16-18 x 11-13) microm, with a L/W ratio of 1.4 and a SB, SSB, and SR. Oocysts of *Caryospora zacapensis* n. sp. from *Masticophis mentovarius* are spheroidal to subspheroidal, 22.5 x 21.8 (19-25 x 18-25) microm, with a L/W ratio of 1.0; they lack a M and OR, but 1 large PG is usually present. Sporocysts are ovoidal, 14.6 x 11.4 (11-16 x 10-13) microm, with a L/W ratio of 1.3 and a SB, SSB, and SR.

Descriptors: Guatamala, snakes, coccidiosis, parasitology , six new species, coccidia, oocysts, *Caryospora* spp., sporulated oocysts.

Shrivastav, A.B., R.K. Chaudhry, S.K. Mittal, R.K. Sharma, and P.K. Malik (2003). **Pseudophyllidean tapeworm infection in common indian monitor lizard (*Varanus bengalensis*).** *Zoos' Print* 18(9): 1203. ISSN: print: 0971-6378; online: 0973-2543.

Descriptors: reptiles, Indian monitor lizard, *Varanus bengalensis*, parasites, tapeworm, infection.

Siddall, M.E. and E.S. Gaffney (2004). **Observations on the leech *Placobdella ornata* feeding from bony tissues of turtles.** *Journal of Parasitology* 90(5): 1186-1188. ISSN: 0022-3395.

NAL Call Number: 448.8 J824

Abstract: The leech *Placobdella ornata* was observed feeding from the blood sinuses of the plastron and carapace bones of *Chelydra serpentina* and *Chrysemys picta*. Evidence of successful feeding included blood upwelling from the point of attachment and gastric ceca of the leeches freshly filled with blood after removal. There was an apparent preference for the sulci between scales of the shell.

Descriptors: reptiles, leech, *Placobdella ornata*, feeding, bony tissues, blood sinuses, plastron, turtles, *Chelydra serpentina* and *Chrysemys picta*.

Silva, E.O., J.A. Diniz, R. Lainson, R.A. DaMatta, and W. de Souza (2005). **Ultrastructural aspects of *Fallisia effusa* (Haemosporina: Garniidae) in thrombocytes of the lizard *Neusticurus bicarinatus* (Reptilia: Teiidae).** *Protist* 156(1): 35-43. ISSN: 1434-4610.

Abstract: The fine structure of the different stages of the *Fallisia effusa* (Haemosporina: Garniidae), infecting the thrombocytes of the semi-aquatic Amazonian lizard *Neusticurus bicarinatus* (Reptilia: Teiidae) is described. Gametocytes, meronts, and merozoites of *Fallisia effusa* were found within a parasitophorous vacuole (PV). Multiple infections of micro- and macrogametocytes were observed. A circumferential coil of microtubules was seen in the cytoplasm of the infected host cell and this microtubule array was pronounced in cells harboring gametocytes. A deep invagination of the inner membrane complex of gametocytes may be involved in nutrition. The non-pigmented parasites underwent both merogony and gametogony in thrombocytes of the peripheral blood. No infection of the erythrocytes was observed. These observations confirm that *Fallisia effusa* displays characteristic features distinguishing it from other members of the Haemosporidian families, and that it has the ability to modulate microtubule assembly.

Descriptors: lizard, Amazonian lizard, *Neusticurus bicarinatus*, thrombocytes, *Fallisia effusa*, ultrastructural aspects, gametocytes, peripheral blood, merozoites, meronts, macrogametocytes.

Silva, E.O., J.A. Diniz, R. Lainson, R.A. DaMatta, and W. de Souza (2006). **Ultrastructural study of the gametocytes and merogonic stages of *Fallisia audaciosa* (Haemosporina: Garniidae) that infect neutrophils of the lizard *Plica umbra* (Reptilia: Iguanidae).** *Protist* 157(1): 13-19. ISSN: 1434-4610.

Abstract: Little is known regarding the ultrastructure of the genus Fallisia (Apicomplexa: Haemosporina: Garniidae). This report describes the fine structure of some developmental stages of *Fallisia audaciosa* that infect neutrophils in the peripheral blood of the Amazonian lizard *Plica umbra* (Reptilia: Iguanidae). The parasites lie within a parasitophorous vacuole and exhibit the basic structures of members of the Apicomplexa, such as the pellicle and the cytostome. Invaginations of the inner membrane complex were seen in the gametocytes and may be concerned with nutrition. The meronts were irregularly shaped before division, a feature unusual among members of the Apicomplexa. The unusual presence of a parasitic protozoan within neutrophils, in some way interfering with or modulating the microbicidal activity of such cells, is discussed.

Descriptors: reptiles, Amazonian lizard, *Plica umbra*, ultrastructural study, genetocytes, merogenic stages, *Fallisia audaciosa*, neutrophils, blood, parasites.

Silva, E.O., J.P. Diniz, S. Alberio, R. Lainson, W. de Souza, and R.A. DaMatta (2004). **Blood monocyte alteration caused by a hematozoan infection in the lizard *Ameiva ameiva* (Reptilia: Teiidae).** *Parasitology Research* 93(6): 448-456. ISSN: 0932-0113.

NAL Call Number: QL757.P377

Abstract: Although hematozoa have been described from many different host species, little is known about the infection and its relationship to the physiology of the host. We studied a hematozoan, regarded as a species of *Lainsonia Landau*, 1973 (Lankestereliidae), which infects the monocytes of the lizard *Ameiva ameiva*. The infected animals show a huge mono-

cytosis and morphological changes in the monocytes. Ultrastructurally, the parasite has an apical complex, dense bodies, electron lucent structures, plasma membrane projections and folding which may be involved with nutrition. The parasite occupies a parasitophorous vacuole (PV) exhibiting high electron density at its membrane. Mitochondria and the Golgi complex of the monocytes were concentrated around the PV, and the cytoplasm was totally occupied by a vimentin type of intermediate filament radiating from (or to) the cytosolic surface of the PV. Vimentin was identified by diameter measurement, immunofluorescence and immunoelectron microscopy. These observations indicate that this infection alters the physiological state of the host and suggest that this parasite has the ability to modify monocyte vimentin assembly.
Descriptors: reptiles, lizard, *Ameiva ameiva*, parasites, hematozoan, lizard, blood monocyte, alteration, infection, monocytosis.

Singh, H.S., Priyavrat Arya, Neeraj Kumar, and Yougesh Kumar (2003). **Helminth fauna of wall lizards at Meerut**. *Journal of Experimental Zoology, India* 6(1): 195-204. ISSN: 0972-0030.
Descriptors: reptiles, helminth fauna, lizards, Hemidactylus, Trematoda, Meerut India.

Siroky, P. and D. Modry (2005). **Two new species of *Eimeria* (Apicomplexa: Eimeriidae) from Asian geoemydid turtles *Kachuga tentoria* and *Melanochelys trijuga* (Testudines: Geoemydidae).** *Parasite* 12(1): 9-13. ISSN: 1252-607X.
NAL Call Number: QL757.P3737
Abstract: Coprological examination of ten Pink-ringed tent turtles *Kachuga tentoria circumdata*, recently imported from India, and three Burmese black turtles *Melanochelys trijuga edeniana*, imported from Myanmar, revealed the presence of two new species of Eimeria. Oocysts of *Eimeria kachua* n. sp. from *K. t. circumdata* are broadly oval to subspherical, 15.3 (13-18) x 13.9 (12-16) microm, with polar granule and subspherical oocyst residuum. Sporocyst elongatelly oval to spindle-shaped, 8.7 (7.5-10) x 4.9 (4-6) microm, with a knob-like Stieda body, covered with fine membranous cupola-like structures. Thin walled oocysts of *Eimeria patta* n. sp. from *M. t. edeniana*, have an irregular shape, influenced by the position of sporocysts, frequently with lobular irregularities, 12.6 (11-16) x 9.1 (7.5-12) microm. Sporocysts are oval to ellipsoidal, 5.8 (5-7) x 4.2 (3.5-5) microm.
Descriptors: turtles, coccidiosis, *Eimeria* classification, parasitology, oocysts, sporocyst, parasites, Myanmar India.

Slapeta, J.R., D. Modry, J. Ashe, and B. Koudela (2003). **Description of *Eimeria arabukosokokensis* sp. n. (Apicomplexa: eimeriidae) from *Telescopus semiannulatus* (Serpentes: Colubridae) with notes on eimerian coccidia from snakes of Eastern Kenya.** *Folia Parasitologica* 50(1): 23-30. ISSN: 0015-5683.
NAL Call Number: 436.8 C33
Abstract: Parasitological examination of faeces of 26 snakes kept in Bio-Ken Snake Farm, Watamu, Kenya revealed new species of *Eimeria Schneider,* 1875 in *Telescopus semiannulatus* Smith, 1849. Oocysts of *Eimeria arabukosokokensis* sp. n. are cylindrical 26.8 (25-29) x 15.1 (14-16) microm with smooth, bilayered oocyst wall and a single polar granule. The broadly ellipsoidal sporocysts average 9.3 (8.5-10) x 7.1 (6.5-7.5) microm and possess single-layered

wall composed of two plates joined by longitudinal suture. *Caryospora cf. regentensis* Daszak et Ball, 2001 is reported from *Dendroaspis angusticeps* (Smith, 1849) and two additional forms of *Caryospora Lege*r, 1904 are reported and morphologically characterised from a single specimen of *Psammophis orientalis* Broadley, 1977. Systematic status of *Caryospora spp.* in sub-Saharan *Psammophis Boie*, 1827 is discusses and all species reported by various authors to date are suggested to be treated as species inquirendae until more detailed data on these parasites and their hosts are available.
Descriptors: reptiles, snakes, eimerian coccidia, *Eimeria arabukosokokensis*, parasitological examination, oocysts, Kenya.

Stenos, J., S. Graves, V.L. Popov, and D.H. Walker (2003). ***Aponomma hydrosauri*, the reptile-associated tick reservoir of *Rickettsia honei* on Flinders Island, Australia**. *American Journal of Tropical Medicine and Hygiene* 69(3): 314-317. ISSN: 0002-9637.
Online: http://www.ajtmh.org/cgi/content/abstract/69/3/314?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&author1=stenos&fulltext=reptile&andorexactfulltext=and&searchid=1&FIRSTINDEX=0&sortspec=relevance&resourcetype=HWCIT
Abstract: *Rickettsia honei* is the aetiological agent of Flinders Island (Australia) spotted fever. The tick *Aponomma hydrosauri* is associated with reptiles and is the arthropod reservoir for this rickettsia on Flinders Island. The rickettsia appears to be maintained in the tick via vertical transmission. Of 46 ticks examined, 29 (63%) were positive for spotted fever group rickettsiae by detection of the citrate synthase gene by a polymerase chain reaction (PCR). From the positive tick samples, seven were sequenced and found to be 100% homologous with *R. honei*. Of 17 reptiles examined, none had evidence of rickettsiae by PCR or culture of blood. *Courtesty of CAB Abstracts.*
Descriptors: reptiles, tick reservoir, rickettsia, spotted fever, arthropod reservoir, vertical transmission, Australia.

Telford, S.R.J., J.F. Butler, and R.S. Telford (2005). ***Hepatozoon polytopis* n. sp. parasitic in two genera and species of colubrid snakes in southern Florida.** *Journal of Parasitology.* 91(1): 144-147. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: *Hepatozoon polytopis*, described from *Coluber constrictor priapus* from Palm Beach County, Florida, has short, usually broad gamonts 12.8 x 4.6 microm (10.0-15.0 x 3.5-6.0), with LW 58.5 microm2 (42-84) and L/W 2.84 (1.8-3.7). Nuclei commonly extend into first quarter of gamont (45%), are always present in second quarter, and seldom in third quarter (11%), with dimensions 4.5 x 3.4 (3.0-6.0 x 2.5-4.5) and LW 15.1 (10.0-24.0). Spherical to ovoid oocysts, 122.1 x 104.9 (62-240 x 57-190), with L/W 1.17 (1.0-1.9), contain 31.3 (3-103) sporocysts. Spherical to ovoid sporocysts, 38.0 x 33.9 (28-73 x 25-58), with LW 1,325.1 (756-4,168) and L/W 1.12 (1.0-1.4), contain 42.9 (22-64) sporozoites. *Thamnophis sauritus sackenii* from Palm Beach County is infected also by *H. polytopis*, as indicated from similar gamont dimensions and verified by isolation of an identical haplotype of the 18S ribosomal RNA gene from both host species.
Descriptors: *Hepatozoon polytopis*, coccidiosis, Colubridae parasitology, epidemiology, para-

sitology, eucoccidiida genetics, physiology, ultrastructure, oocysts physiology, ultrastructure, prevalence, RNA, Florida.

Telford, S.R.J., J.F. Butler, and R.S. Telford (2002). ***Hepatozoon* species (Apicomplexa: Hepatozoidae) of the corn snake, *Elaphe guttata* (Serpentes: Colubridae) and the pigmy rattlesnake, *Sistrurus miliarius barbouri* (Serpentes: Viperidae) in south Florida.** *Journal of Parasitology.* 88(4): 778-782. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: *Hepatozoon guttata n*. sp. is described from the corn snake (*Elaphe guttata guttata*) from south Florida. Gamonts average 14.6 x 4.6 (13-17 x 3.5-6) and are not recurved, with nucleus situated in the second quarter of the gamont. Erythrocyte cytoplasm rarely appears partially dehemoglobinized. The infected cells are usually distorted and are longer than the uninfected erythrocytes but do not differ in width; nuclei are smaller in length and width than those of uninfected cells. Sporogony in *Aedes aegypti* occurs within the head and the thorax but rarely in the abdomen. Oocysts are spherical to usually ovoid, 87.2 x 75.9 (45-155 x 40-152.5) and contain on average 7.1 (2-32) sporocysts. Sporocysts are spherical to ovoid, 34.8 x 31.0 (20-55 x 17.5-47.5), with 45.7 (14-89) sporozoites contained within. The pigmy rattlesnake (*Sistrurus miliarius barbouri*) in south Florida is parasitized by *H. sistruri n*. sp. Gamonts average 14.1 x 5.6 (12.6-15.8 x 4.7-6.3) in breadth and are not recurved, with the nucleus always situated in the second quarter of the gamont commonly at the midbody. Erythrocyte cytoplasm is not dehemoglobinized. The infected cells are always distorted and similar in length to the uninfected cells but with greater width and enlarged nuclei. Sporogony in *A. aegypti* occurs within head, thorax, and abdomen. Oocysts are spherical to usually ovoid, 163.6 x 154.7 (92-245 x 82-240) and contain 27.4 (12-42) sporocysts. Sporocysts are round to usually ovoid, 39.7 x 33.5 (25-50 x 20-50), with 45.7 (19-70) sporozoites.
Descriptors: reptiles, corn snake, *Elaphe guttata guttata*, pigmy rattle snake, *Sistrurus miliarius barbouri*, parasites, *Hepatozoon guttata*, *Aedes aegypti*, erythrocytes, oocysts, Florida.

Telford, S.R.J. and S.R.3. Telford (2003). **Rediscovery and redescription of *Plasmodium pifanoi* and description of two additional Plasmodium parasites of Venezuelan lizards.** *Journal of Parasitology.* 89(2): 362-368. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: *Plasmodium pifanoi* Scorza and Dagert B., known only from the type host, *Ameiva ameiva*, is redescribed from *Kentropyx calcarata* collected in Territorio Amazonas, Venezuela. Schizonts, 6.2 x 4.5 (4-8 x 3-6), produce on average 11.9 (7-16) merozoites. Gametocytes average 12.4 x 6.0 (8-16 x 4-10), with length x width (LW) 72.9 (52-112) and L/W 2.18 (1.1-3.3), and always contain 1-5 prominent vacuoles. Macrogametocytes in active infection are longer than microgametocytes, with greater LW, but gametocytes in chronic infection are not sexually dimorphic in dimension and are slightly smaller. Two additional malarial parasites are described from *K. calcarata*. *Plasmodium lepidoptiformis* has small schizonts, 4.6 x 3.2 (3-6 x 2.5-3), that produce 5.1 (4-8) merozoites and commonly resemble a butterfly in appearance. Gametocytes are elongate, 9.0 x 4.3 (7-10 x 3-6), with LW 38.3 (24-51) and L/W 2.2 (1.3-3.3), and sexually dimorphic, with macrogametocytes longer than microgame-

tocytes, with greater LW. *Plasmodium minasense calcaratae* is characterized by very small, usually fan-shaped, schizonts. 3.4 x 2.6 (2.5-4.5 x 2.0-3.0), that produce 3.9 (3-4) merozoites. Gametocytes are spherical or ovoid, 6.7 x 5.0 (4.5-9.0 x 3.0-7.0), with LW 33.7 (15-54) and L/W 1.4 (1.0-2.3), with no sexual dimorphism in dimensions.
Descriptors: reptiles, lizards, *Kentropyx calcarata*, *Plasmodium pifanoi*, parasites, rediscovery, redescription, malarial parasites, Venezuela.

Tkach, V.V. and S.D. Snyder (2003). ***Acanthostomum macroclemidis* n. sp. (Digenea: Cryptogonimidae: Acanthostominae) from the alligator snapping turtle, *Macroclemys temmincki*.** *Journal of Parasitology.* 89(1): 159-167. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: *Acanthostomum macroclemidis* n. sp. is described from specimens found in the intestine of an alligator snapping turtle *Macroclemys temmincki* from southern Mississippi. The most important diagnostic features of the new species are the general shape and proportions of the body, the position of the pharynx (relative length of the prepharynx and esophagus), the egg size, the relative length and position of the vitelline fields, and the number, shape, and size of the circumoral spines. The new species has a very elongated body (length-width ratio, 8.9-13.0:1), 26 circumoral spines, which are almost oval in shape, a long prepharynx and a very short (shorter than the pharynx) esophagus, a seminal receptacle situated between the ovary and the anterior testis, a uterus not extending posterior to the anterior margin of the ovary, a long-stemmed and short-armed excretory vesicle, and 2 anal openings. Some features of the external morphology, such as the suckers, circumoral spines, sensory papillae, tegumental spines, and morphology of the posterior end, are examined using scanning electron microscopy. A diagnosis differentiating *A. macroclemidis* n. sp. from some other acanthostomine digeneans is provided. *Acanthostomum macroclemidis* n. sp. is the first digenean reported from an alligator snapping turtle and represents the northernmost record of an acanthostomine from turtles.
Descriptors: reptiles, alligator snapping turtle, *Macroclemys temmincki*, parasites, *Acanthostomum macroclemidis*, intestine, diagnostic features.

Tkach, V.V. and S.D. Snyder (2006). ***Doodytrema carettochelydis* n. gen., n. sp., (Digenea: Microscaphidiidae) from the pig-nosed turtle, *Carettochelys insculpta*, (Cryptodira: Carettochelydidae) in Australia.** *Comparative Parasitology.* 73(2): 165-171. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: reptiles, pig nosed turtle, *Carettochelys insculpta*, *Doodytrema carettochelydis*, microscaphidiid, freshwater turtles, Australia.

Townsend, J.H., H.C. Aldrich, L.D. Wilson, and J.R. McCranie (2005). **First report of sporangia of a myxomycete (*Physarum pusillum*) on the body of a living animal, the lizard *Corytophanes cristatus*.** *Mycologia* 97(2): 346-348. ISSN: 0027-5514.
NAL Call Number: 450 M99
Abstract: Myxomycetes are protists whose life cycle depends on aerially dispersed spores that germinate into motile myxamoebae, which then pair and fuse to form a larger, motile

plasmodium. The plasmodium seeks out a suitable fruiting site (usually atop vegetative material or detritus) and transforms into fruiting bodies that release the spores. In this paper we report the first known instance of a myxomycete, in this case *Physarum pusillum*, sporulating on the body of a living animal, the cryptic lizard *Corytophanes cristatus*, which was collected in eastern Honduras in 2003.
Descriptors: lizards, *Corytophanes cristatu*, parasitology, physarum growth, development, physarum cytology, isolation, purification, skin parasitology, spores, protozoan cytology, Honduras.

Uller, T. and M. Olsson (2003). **Prenatal exposure to testosterone increases ectoparasite susceptibility in the common lizard (*Lacerta vivipara*).** *Proceedings of the Royal Society of London. Series B, Biological Sciences* 270(1526): 1867-1870. ISSN: 0080-4649.
Abstract: High levels of testosterone can benefit individual fitness, for example by increasing growth rate or ornament size, which may result in increased reproductive success. However, testosterone induces costs, such as a suppressed immune system, thereby generating trade-offs between growth or mate acquisition, and immunity. In birds and reptiles, females allocate steroids to their eggs, which may be a mechanism whereby females can influence the phenotype of their offspring. To our knowledge, only the benefits of early androgen exposure have been experimentally investigated to date. However, to understand this phenomenon, the costs also need to be evaluated. We manipulated testosterone levels in eggs of the viviparous common lizard and monitored growth, endurance and post-parturient responses to ectoparasites of the offspring. Testosterone-treated individuals had significantly higher growth rates than controls, but suffered a significant decrease in growth rate when exposed to ticks, whereas the corresponding difference for controls was non-significant. There was no difference in observed parasite load or leucocyte count between manipulated and control offspring. Thus, our results suggest that high testosterone levels during embryonic development have detrimental effects on immune function resulting in reduced growth rate, and that this must be taken into consideration when evaluating the potential adaptive value of maternal androgen allocation to eggs.
Descriptors: reptiles, lizard, *Lacerta vivipara*, testosterone, prenatal exposure, ectoparasite, increased suceptibility, suppressed immune system.

Uller, T. and M. Olsson (2004). **Ectoparasite susceptibility in lizards from populations sympatric and allopatric with ticks.** *Ecoscience* 11(4): 428-432. ISSN: 1195-6860.
NAL Call Number: QH540.E366
Descriptors: reptiles, lizards, ectoparasites, susceptibility, populations, ticks, sympatric, allopatric.
Language of Text: English; French.

Vardo, A.M., A.R. Wargo, and J.J. Schall (2005). **PCR detection of lizard malaria parasites: prevalence of *Plasmodium* infections with low-level parasitemia differs by site and season.** *Journal of Parasitology.* 91(6): 1509-1511. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Abstract: Plasmodium-specific polymerase chain reaction (PCR) primers allowed detec-

tion of infections with very low-level parasitemia for 3 species of malaria parasites infecting Anolis lizards at 2 Caribbean sites, Puerto Rico and Saba, Netherlands Antilles. A verification study, using a single-tube nested PCR to eliminate contamination, showed that infections as low as 1 parasite per millions of erythrocytes could be detected by amplifying a 673 bp fragment of the cytochrome b gene. Very low-level parasitemia infections, subpatent under the microscope, were common in *A. sabanus* on Saba sites, with no significant seasonal difference (31% of infections appearing uninfected by microscopic examination in summer were found infected by PCR, 38% in winter). At the Puerto Rico site, the subpatent infections were also common in *A. gundlachi*, but were more prevalent in winter (53%) than in summer (17%). A similar high frequency of subpatent infections is known from studies on human and bird malaria, but a previous PCR-based study on a temperate lizard malaria system found few such low-level infections. Differences in the prevalence of subpatent infections by site and season suggest transmission biology may select for distinct life history strategies by the parasite.

Descriptors: lizards, parasitology, malaria, *Plasmodium* isolation, purification, polymerase chain reaction, DNA, protozoan, blood, malaria diagnosis, epidemiology, epidemiology, parasitemia, epidemiology, plasmodium genetics, polymerase chain reaction standards, prevalence, epidemiology, seasons, sensitivity, Puerto Rico, Netherlands Antilles.

Venzal, J.M. and A. Estrada Pena (2006). **Larval feeding performance of two Neotropical *Ornithodoros* ticks (Acari: Argasidae) on reptiles.** *Experimental and Applied Acarology* 39(3-4): 315-320. ISSN: print: 0168-8162; online: 1572-9702.

NAL Call Number: SB940.E9

Abstract: This paper determines the feeding performance of the larvae of two Neotropical soft tick species namely *Ornithodoros rostratus Aragao*, 1911 and *O. puertoricensis Fox*, 1947 on reptiles (Gekkonidae) using rabbits, mice and guinea pigs to provide comparisons with feeding features on mammals. *O. puertoricensis* produced a larval feeding rate of 63% on reptiles, while that of *O. rostratus* was only 20%. But the final success (attaching + feeding) was similar, 12.4% for *O. puertoricensis* and 10.4% for *O. rostratus*. The feeding time was also very different for both species. In *O. puertoricensis*, detachment begins at 16th day and lasts until day 27. In *O. rostratus* detachment begins at 1.5 h and lasts until day 10. These values of feeding on reptiles are different from those obtained on mammals (average 5.6 days for *O. puertoricensis* and 2.9 for *O. rostratus*).

Descriptors: reptiles, *Ornithodoros*, Gekkonidae, tick infestations, larvae, feeding behavior, host parasite relationships, *Ornithodoros rostratus*, *Ornithodoros puertoricensis*, *Tarentola mauritanica*, feeding time, tick attachment, tick detachment.

Vrcibradic, D., J.J. Vicente, and C.R. Bursey (2007). **Helminths infecting the lizard *Enyalius bilineatus* (iguanidae; leiosaurinae) from an Atlantic rainforest area in Espirito santo State, southeastern Brazil**. *Amphibia Reptilia* 28(1): 166-169. ISSN: 0173-5373.

Descriptors: reptiles, helminths, lizard, nematodes, acanthocephalan, Atlantic rain forest, Espirito santo State, Brazil.

Xiao, L., U.M. Ryan, T.K. Graczyk, J. Limor, L. Li, M. Kombert, R. Junge, I. Sulaiman, and L. Zhou (2004). **Genetic diversity of *Cryptosporidium* spp. in captive reptiles.** *Applied and Environmental Microbiology* 70(2): 891-899. ISSN: print: 0099-2240; online: 1098-5336.
Online: http://dx.doi.org/10.1128/AEM.70.2.891-899.2004
NAL Call Number: 448.3 Ap5
Abstract: The genetic diversity of *Cryptosporidium* in reptiles was analyzed by PCR-restriction fragment length polymorphism and sequence analysis of the small subunit rRNA gene. A total of 123 samples were analyzed, of which 48 snake samples, 24 lizard samples, and 3 tortoise samples were positive for *Cryptosporidium*. Nine different types of *Cryptosporidium* were found, including *Cryptosporidium serpentis*, *Cryptosporidium* desert monitor genotype, *Cryptosporidium muris*, *Cryptosporidium parvum bovine* and mouse genotypes, one *C. serpentis*-like parasite in a lizard, two new *Cryptosporidium* spp. in snakes, and one new *Cryptosporidium* sp. in tortoises. *C. serpentis* and the desert monitor genotype were the most common parasites and were found in both snakes and lizards, whereas the *C. muris* and *C. parvum* parasites detected were probably the result of ingestion of infected rodents. Sequence and biologic characterizations indicated that the desert monitor genotype was *Cryptosporidium saurophilum*. Two host-adapted *C. serpentis* genotypes were found in snakes and lizards.
Descriptors: reptiles, zoo animals, snakes, lizards, tortoises, *Cryptosporidium*, cryptosporidiosis, animal parasites, pests, genetic variation, nucleotide sequences, ribosomal RNA, genes, polymerase chain reaction, restriction fragment length polymorphism, disease transmission, epidemiology , molecular sequence data.

Yu, M.C., T.C. Orlando, N.R. Sturm, L. Zhou, R.M. Saito, L.M. Floeter Winter, and D.A. Campbell (2002). **Two distinct functional spliced leader RNA gene arrays in *Leishmania tarentolae* are found in several lizard *Leishmania* species.** *International Journal for Parasitology* 32(11): 1411-1422. ISSN: 0020-7519.
NAL Call Number: QH547.I55
Abstract: A second distinct array of spliced leader RNA genes has been found in several *Leishmania* species particular to lizards. This is the first report of two non-allelic arrays of spliced leader RNA genes within a species cell line. The arrays are identical to each other in their transcribed spliced leader RNA gene sequences, but variable in their non-transcribed spacer sequences. In the two arrays from *Leishmania tarentolae* UC strain the promoter regions are similar, but not identical, at positions shown previously to be critical for spliced leader RNA transcription. These arrays contain similar numbers of genes and are both transcribed in *L. tarentolae* in vitro transcription extract as well as in vivo. The -66/-58 regions of both genes, which contain an element of the spliced leader RNA gene promoter, bind proteins likely to be transcription factors in a specific manner. A survey of lizard *Leishmania* spp. revealed a second spliced leader RNA gene array in three of four species. Phylogenetic analyses of these sequences with each other and with the spliced leader RNA gene sequences of non-lizard *Leishmania* spp. and their near-relatives showed that the lizard groups are more closely related to each other than to arrays from other *Leishmania* spp. As the transcripts of the two arrays are identical, they may co-exist to fulfil the substantial requirement for spliced leader RNA production; however, they have the potential for differential usage modulated by their distinct promoter elements. The presence of two distinct spliced leader RNA gene arrays

within a single cell type may represent dissociated evolution of two redundant loci, or a previously unsuspected level of control in the post-transcriptional gene expression within some kinetoplastids.

Descriptors: reptiles, lizards, parasites, *Leishmania* species, RNA gene arrays, spliced leader, cell line.

Zamparo, D., D.R. Brooks, V. Tkach, and B. Rodriguez (2004). ***Parallopharynxs* pp. (Trematoda: Digenea: Plagiorchioidea) in iguanian lizards from the Area de Conservacion Guanacaste, Guanacaste, Costa Rica, including *Parallopharynx matternae n*. sp. in *Chaetodon basiliscus* (Squamata: Iguania: Corytophanidae).** *Journal of Parasitology.* 90(2): 359-363. ISSN: 0022-3395.

NAL Call Number: 448.8 J824

Abstract: We report 3 species of the digenean genus *Parallopharynx*, 1 previously undescribed, from the Area de Conservacion Guanacaste (ACG) in northwestern Costa Rica. *Parallopharynx gonzalezi*, which was originally described in *Basiliscus* sp. and *Ctenosoura similis* from central Costa Rica, inhabits *C. quinquecarinata*; *P. jonesi*, originally described in *Anolis lionotus* (syn. *Norops oxylophus*) from Nicaragua, inhabits *N. oxylophus, N. biporcatus*, and *Basiliscus basiliscus*; and the new species, which inhabits *B. basiliscus*. *Parallopharynx matternae n*. sp. differs from all other members of the genus by having a metraterm extending posteriad from the genital pore to the posterior margin of the ventral sucker, whereas in *P. arctus* and *P. gonzalezi*, the metraterm never surpasses the midlevel of the ventral sucker and in *P. jones*i it never passes the anterior margin of the ventral sucker, and by having an oral sucker that does not exceed 150 microm in diameter with a subsequent greater oral-ventral sucker width ratio ranging from 1:0.88-1.12 (averaging 1:1), whereas values range from 1:0.71-0.83 for P. gonzalezi and P. arctus, and from 1:0.59-0.68 for *P. jonesi*. Parallopharynx spp. possesses Y-shaped excretory vesicles with a long central stem and short arms bifurcating immediately posterior to the ovary; similar to those found in members of the Telorchiidae. Additional similarities in the relative positions of the gonads and the structure of the cirrus sac and metraterm indicate a close relationship between Parallopharynx and members of the Telorchiidae.

Descriptors: reptiles, iguana lizards, trematoda, trematode infections, *Parallopharynx gonzalezi*, trematoda anatomy, histology, parasitology, Costa Rica.

Zhou, L., C. Yang, and L. Xiao (2003). **PCR-mediated recombination between *Cryptosporidium* spp. of lizards and snakes.** *Journal of Eukaryotic Microbiology* 50(Suppl.): 563-565. ISSN: 1066-5234.

Abstract: The presence or absence of genetic recombination has often been used as one of the criteria for *Cryptosporidium* species designation and population structure delineation. During a recent study of cryptosporidiosis in reptiles that were housed in the same room, 4 lizards were found to have concurrent infections of *C. serpentis* (a gastric parasite) and *C. saurophilum* (an intestinal parasite), and 6 snakes were concurrently infected with *C. serpentis, C. saurophilum* and a new *Cryptosporidium* as indicated by PCR-RFLP analysis of the SSU rRNA gene. DNA sequence analysis of cloned PCR products confirmed the diagnosis of mixed infections. Surprisingly, it appeared that 11 of the 22 clones (8 and 14 clones

from a lizard and a snake, respectively) had chimeric sequences of two *Cryptosporidium* spp. BootScan analysis indicated the existence of recombinants among the cloned sequences and detection of the informative sites confirmed the BootScan results. Because the probability for genetic recombination between gastric and intestinal parasites is small, these hybrid sequences were likely results of PCR artifacts due to the presence of multiple templates. This was confirmed by PCR-sequencing analysis of single-copy templates using diluted DNA samples. Direct sequencing of 69 PCR products from 100- to 1,000-fold diluted DNAs from the same snake and lizard produced only sequences of *C. serpentis, C. saurophilum* and the unnamed *Cryptosporidium* sp. Thus, care should be taken to eliminate PCR artifacts when determining the presence of genetic recombination or interpreting results of population genetic studies.

Descriptors: reptiles, lizards, snakes, *Cryptosporidium*, PCR, mediated recombination, genetic rcombination, boot scans, PCR sequencing, captive animals.

Regeneration

Alibardi, L. and M. Toni (2005). **Wound keratins in the regenerating epidermis of lizard suggest that the wound reaction is similar in the tail and limb.** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 303(10): 845-860. ISSN: 1548-8969.
NAL Call Number: QL1.J854
Descriptors: epidermis, extremities, keratins, lizard physiology, tail physiology, wound healing, amputation stumps, immunohistochemistry, keratinocytes.

Avallone, B., M. Porritiello, D. Esposito, R. Mutone, G. Balsamo, and F. Marmo (2003). **Evidence for hair cell regeneration in the crista ampullaris of the lizard *Podarcis sicula*.** *Hearing Research* 178(1-2): 79-88. ISSN: 0378-5955.
Abstract: We studied hair cell regeneration in the crista ampullaris of the lizard *Podarcis sicula* both in untreated animals and at early and late time intervals following a single high dose of gentamicin. The study was carried out using the S-phase marker 5-bromo-2'-deoxyuridine. Our ultrastructural and immunofluorescence studies showed that both apoptosis and hair cell regeneration happen in the lizard crista ampullaris in untreated animals, and that regenerative processes are greatly accelerated after treatment with the aminoglycoside antibiotic gentamicin. Our observations indicate that hair cell regeneration is strongly implicated in the repair of damaged sensory epithelium, and that new hair cells appear likely to arise from supporting cells.
Descriptors: reptiles, lizard, hair cell regeneration, crista ampullaris , gentamicin, apoptosis, repair, damaged sensory epithelium.

Blacker, H.A., C. Tsopelas, S. Orgeig, C.B. Daniels, and B.E. Chattertonz (2007). **How regenerating lymphatics function: lessons from lizard tails**. *Anatomical Record* 290(1): 108-114. ISSN: 0003-276X.
Descriptors: reptiles, lizard, tails, regenerating lymphatics, function, nonlymphoedematous tails, lymphangiogenesis, gecko.

Daniels, C.B., B.C. Lewis, C. Tsopelas, S.L. Munns, S. Orgeig, M.E. Baldwin, S.A. Stacker, M.G. Achen, B.E. Chatterton, and R.D. Cooter (2003). **Regenerating lizard tails: A new model for investigating lymphangiogenesis.** *FASEB Journal* 17(3): 479-481. ISSN: print: 0892-6638; online: 1530-6860.
NAL Call Number: QH301.F3
Abstract: Impaired lymphatic drainage in human limbs causes the debilitating swelling termed lymphoedema. In mammals, known growth factors involved in the control of lymphangiogenesis (growth of new lymph vessels) are vascular endothelial growth factors-C and -D (VEGF-C/D). Here we characterize a model of lymphangiogenesis in which the tail of lizards is regenerated without becoming oedematous. Three weeks after the tail is shed (autotomy), there are a small number of large diameter lymphatic vessels in the regenerated tail. Thereafter, the number increases and the diameter decreases. A functional lymphatic

network, as determined by lymphoscintigraphy, is established 6 wk after autotomy. The new network differs morphologically and functionally from that in original tails. This lymphatic regeneration is associated with an up-regulation of a reptilian homologue of the VEGF-C/D protein family (rVEGF-C/D), as determined by Western blot analysis using a human reactive VEGF-C polyclonal antibody. Regenerating lizard tails are potentially useful models for studying the molecular basis of lymphangiogenesis with a view to developing possible treatments for human lymphoedema.
Descriptors: reptiles, lizard tails, regenerating, new model, investigating, lymphangiogenesis.

Fitch, H.S. (2003). **A comparative study of loss and regeneration of lizard tails.** *Journal of Herpetology* 37(2): 395-399. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: reptiles, lizard tails, loss, regeneration, comparative study.

Galis, F., G.P. Wagner, and E.L. Jockusch (2003). **Why is limb regeneration possible in amphibians but not in reptiles, birds, and mammals?** *Evolution and Development* 5(2): 208-220. ISSN: 1520-541X.
Abstract: The capacity to regenerate limbs is very high in amphibians and practically absent in other tetrapods despite the similarities in developmental pathways and ultimate morphology of tetrapod limbs. We propose that limb regeneration is only possible when the limb develops as a semiautonomous module and is not involved in interactions with transient structures. This hypothesis is based on the following two assumptions: To an important extent, limb development uses the same developmental mechanisms as normal limb development and developmental mechanisms that require interactions with transient structures cannot be recapitulated later. In amniotes limb development is early, shortly after neurulation, and requires inductive interactions with transient structures such as somites. In amphibians limb development is delayed relative to amniotes and has become decoupled from interactions with somites and other transient structures that are no longer present at this stage. The limb develops as a semi-independent module. A comparison of the autonomy and timing of limb development in different vertebrate taxa supports our hypothesis and its assumptions. The data suggest a good correlation between self-organizing and regenerative capacity. Furthermore, they suggest that whatever barriers amphibians overcame in the evolution of metamorphosis, they are the same barriers that need to be overcome to make limb regeneration possible in other taxa.
Descriptors: reptiles, amphibians, regeneration, limbs, capacity, tetrapod limb morphology, developmental patyhways, metamorphosis.

Harman, A.M., J. Rodger, A. Ahmat, C. Thomas, C. Bartlett, P. Chen, S.A. Dunlop, and L.D. Beazley (2003). **PSA-NCAM is up-regulated during optic nerve regeneration in lizard but not in goldfish.** *Experimental Neurology* 182(1): 180-185. ISSN: 0014-4886.
Abstract: The addition of polysialic acid (PSA) to neural cell adhesion molecule (NCAM) facilitates axon growth. Here we use Western blots and immunohistochemistry to examine expression of PSA-NCAM during optic nerve regeneration. In lizard, retinal ganglion cell

axons become transiently PSA-NCAM positive. By contrast, goldfish RGC axons are PSA-NCAM negative both in normal animals and throughout regeneration with the exception of a PSA-NCAM-positive fascicle arising from newly generated RGCs. Transient sialylation of NCAM in lizard may assist regeneration in the nonpermissive reptilian visual pathway and facilitate the reestablishment of a crude topographic map; down-regulation in the long term may contribute to the breakdown in topography. The lack of sialylation in goldfish presumably reflects the permissive nature of the substrate allowing axon regeneration and the successful reestablishment of a topographic map.
Descriptors: reptiles, optic nerve, regeneration, lizard, PSA-NCAM up-regulated, retinal ganglion cell axons.

Kuchling, G. (2005). **Bifid tail regeneration in a turtle, *Emydura* sp. (Testudines: Chelidae).** *Chelonian Conservation and Biology* 4(4): 935-937. ISSN: 1071-8443.
Descriptors: reptiles, regeneration, bifid tail, turtle, *Emydura*.

Lang, D.M., M. del Mar Romero Aleman, J.F. Arbelo Galvan, C.A. Stuermer, and M. Monzon Mayor (2002). **Regeneration of retinal axons in the lizard *Gallotia galloti* is not linked to generation of new retinal ganglion cells.** *Journal of Neurobiology* 52(4): 322-335. ISSN: 0022-3034.
NAL Call Number: QP351.J55
Descriptors: reptiles, lizard, *Gallotia galloti*, retinal axons, regeneration, new retinal ganglion cells.

Lin, Z.H. and X. Ji (2005). **Partial tail loss has no severe effects on energy stores and locomotor performance in a lacertid lizard, *Takydromus septentrionalis*.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 175(8): 567-573. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: Many species of lizards use caudal autotomy as a defense strategy to avoid predation, but tail loss entails costs. These topics were studied experimentally in the northern grass lizard, *Takydromus septentrionalis*. We measured lipids in the three-tail segments removed from each of the 20 experimental lizards (adult females) initially having intact tails to evaluate the effect of tail loss on energy stores; we obtained data on locomotor performance (sprint speed, the maximal length traveled without stopping and the number of stops in the racetrack) for these lizards before and after the tail-removing treatments to evaluate the effect of tail loss on locomotor performance. An independent sample of 20 adult females that retained intact tails was measured for locomotor performance to serve as controls for successive measurements taken for the experimental lizards. The lipids stored in the removed tail was positively correlated with tailbase width when holding the tail length constant, indicating that thicker tails contained more lipids than did thinner tails of the same overall length. Most of the lipids stored in the tail were concentrated in the proximal portion of the tail. Locomotor performance was almost unaffected by tail loss until at least more than 71% of the tail (in length) was lost. Our data show that partial tail loss due to predatory encounters or other factors may not severely affect energy stores and locomotor performance in *T. septentrionalis.*

Descriptors: reptiles, lacertid lizard, *Takydromus septentrionalis*, partial tail loss, energy stores, effects, locomotor performance, defense strategy, predation.

Meyer, V., M.R. Preest, and S.M. Lochetto (2002). **Physiology of original and regenerated lizard tails**. *Herpetologica* 58(1): 75-86. ISSN: 0018-0831.
NAL Call Number: QL640.H4
Descriptors: reptiles, lizard tails, regenerated, physiology, original.

Turgut, M., S. Kaplan, K. Metin, Y.B. Koca, E. Soylu , B. Sahin, Z.B. Ateslier, and H.K. Basaloglu (2006). **Effects of constant lightness, darkness and parachlorophenylalanine treatment on tail regeneration in the lizard *Ophisops elegans macrodactylus*: macroscopic, biochemical and histological changes.** *Anatomia, Histologia, Embryologia* 35(3): 155-161. ISSN: 0340-2096.
Abstract: A better understanding of regenerative growth is very important for the development of new potential strategies. Recently, the pineal secretory product melatonin was shown to stimulate the regeneration process. In this study, we carried out an experimental investigation of tail regeneration in young adult lizards, *Ophisops elegans macrodactylus* Berthold, 1842, addressing the role of melatonin on the regeneration process. Lizards were divided into three groups: constant light-exposed control group (n = 13), constant dark-exposed group (n = 15) and parachlorophenylalanine (p-CPA) treatment group exposed to constant light (n = 15). Using a tail autotomy procedure, the effects of p-CPA treatment on connective tissue together with neural tissue and vascular tissue in regenerating tail in lizards were investigated. p-CPA (400 microg/kg body mass) was injected from day 0 to 30 days after autotomy. p-CPA treatment produced a significant increase in the length of the regenerated tail compared with light-exposed control and dark-exposed lizards. Total collagen content was found to be higher in p-CPA-treated animals in comparison with other groups. Histologically, a higher percentage of connective tissue and vascular tissue and a lower percentage of neural tissue were found in the regenerated tails of the p-CPA-treated lizards. Importantly, the percentage of neural tissue in lizards in the dark-exposed animals was higher than that in animals of both light-exposed and p-CPA treatment groups. Thus, it is clear that p-CPA has a stimulatory influence on fibroblast collagen production and vascularization of the regenerated tail in the lizards. Furthermore, it seems that the neural regeneration process was markedly enhanced in lizards exposed to continuous darkness. Based on the results of our study, it is suggested that melatonin may be an active factor that speeds up the rate of tail regeneration in lacertilians.
Descriptors: reptiles, *Ophisops elegans macrodactylus*, lizards physiology, melatonin physiology, pineal gland physiology, regeneration physiology, tail physiology, fenclonine pharmacology, light, random allocation, regeneration drug effects.

Turgut, M., Y.B. Koca, S. Kaplan, K. Metin, N. Uzum, E. Soylu, A. Avc, M.C. Ragbetli, E.P. Beytas, and K. Olgun (2007). **Effects of Ca2+channel blocker verapamil on tissue regeneration in a lizard tail autotomy model: a biochemical and histological study**. *Amphibia Reptilia* 28(1): 7-15. ISSN: 0173-5373.

Descriptors: reptiles, lizard, tail, autotomy model, tissue regeneration, Ca2+ channel blocker verapamil, effects.

Reproduction

Al Dokhi, O.A. (2006). **Ultrastructure of sperm head differentiation in the lizard, *Acanthodactylus boskinus* (Squamata, Reptilia).** *International Journal of Zoological Research* 2(1): 60-72. ISSN: 1811-9786.
Online: http://www.academicjournals.net/2/detail.php?id=2&jid=ijzr&theme=2&issueno=2&articleno=21
NAL Call Number: QL1.I584
Descriptors: reptiles, *Acanthodactylus boskinus*, lizard, sperm head, ultrastructural, differentiation, golgi phase, maturation phase.

Al Dokhi, O.A. and S.H. Al Wasel (2002). **Ultrastructure of spermiogenesis in the freshwater turtle *Mauremys caspica* (Chelonia, Reptilia). III: The sperm tail formation.** *Journal of Union of Arab Biologists Cairo A Zoology* 18: 327-341. ISSN: 1110-5372.
Descriptors: reptiles, freshwater turtle, *Mauremys caspica* , spermiogenesis, sperm tail formation, ultrastructure, Arabia.
Language of Text: Arabic; English.

Al Habsi, A.A., A.Y.A. Alkindi, I.Y. Mahmoud, D.W. Owens, T. Khan, and A. Al Abri (2006). **Plasma hormone levels in the green turtles *Chelonia mydas* during peak period of nesting at Ras Al-Hadd-Oman**. *Journal of Endocrinology* 191(1): 9-14. ISSN: 0022-0795.
Online: http://dx.doi.org/10.1677/joe.1.06790
NAL Call Number: 448.8 J8293
Descriptors: reptiles, green turtles, nesting, peak period, plasma hormone levels, estradiol, progesterone, testosterone, corticosterone.

Alberts, A.C., N.C. Pratt Hawkes and J.A. Phillips (2003). **Ontogeny of captive and wild iguanas: From emergence to mating**. In: E.R. Jacobson *Biology, Husbandry, and Medicine of the Green Iguana,* Krieger Publishing Company: Malabar, USA, p. 28-37. ISBN: 1575240653.
Descriptors: reptiles, green iguana, captive and wild animals, ontogeny, emergence, mating behavior.

Alkindi, A.Y., I.Y. Mahmoud, M.J. Woller, and J.L. Plude (2006). **Oviductal morphology in relation to hormonal levels in the snapping turtle, *Chelydra serpentina* .** *Tissue and Cell* 38(1): 19-33. ISSN: 0040-8166.
Abstract: Microscopic and in situ visual observations were used to relate circulating hormone levels to morphological changes in the oviduct of the snapping turtle *Chelydra serpentina* throughout the ovarian cycle. Increase in levels of progesterone (P), estradiol (E2) and testosterone (T) levels coincide with an increase in number and growth of endometrial glands, luminal epithelial cells and secretory droplets throughout the oviduct. Testosterone and estradiol levels rose significantly ($P < 0.05$) after the May-June period and remained high throughout the rest of the summer. Progesterone levels remained stable throughout the

summer, with a brief decline in July due to luteolysis. Hormonal values declined significantly ($P < 0.001$) at the end of the ovarian cycle in the fall. In situ visual observation of fresh oviducts at different stages of gravidity in recently ovulated turtles revealed that proteinaceous like components from the endometrial glands were released into the lumen to form fibers. The morphological features of the oviduct remained active throughout the summer months even though the snapping turtle is a monoclutch species which deposits all the eggs in late-May to mid-June. The high steroid levels correlate with and may be responsible for the secretory activity present throughout the summer and their decline correlates with change to low secretory activity in the fall. Calcium deposition accompanied by morphological changes in luminal cells are suggestive of secretory activity. In the egg-bearing turtles, uterine Ca2+ concentrations measured by flame atomic absorption spectrophotometry revealed significantly higher Ca2+ concentrations ($P < 0.001$) in eggs with soft shell than eggs without shell. There was a significant increase in calcium granules and proteinaceous fibers in luminal surface of the uterus during the period of eggshelling. This supports the fact that in the snapping turtle like in other reptiles, eggshelling process occurs in the uterus.
Descriptors: snapping turtle, *Chelydra serpentina*, estradiol blood, oviducts anatomy, histology, progesterone, testosterone, turtles anatomy, histology, calcium analysis, egg shell physiology , oviducts cytology, physiology, ovum chemistry, physiology, reproduction, seasons, turtles blood, physiology, uterus anatomy, histology, chemistry, vagina anatomy, histology.

Allsop, D.J., D.A. Warner, T. Langkilde, W. DU, and R. Shine (2006). **Do operational sex ratios influence sex allocation in viviparous lizards with temperature-dependent sex determination?** *Journal of Evolutionary Biology* 19(4): 1175-1182. ISSN: 1010-062X.
Abstract: Under certain environmental situations, selection may favour the ability of females to adjust the sex ratio of their offspring. Two recent studies have suggested that viviparous scincid lizards can modify the sex ratio of the offspring they produce in response to the operational sex ratio (OSR). Both of the species in question belong to genera that have also recently been shown to exhibit temperature-dependent sex determination (TSD). Here we test whether pregnant montane water skinks (*Eulamprus tympanum*) utilise TSD to select offspring sex in response to population wide imbalances in the OSR, by means of active thermoregulation. We use a combination of laboratory and field-based experiments, and conduct the first field-based test of this hypothesis by maintaining females in outdoor enclosures of varying OSR treatments throughout pregnancy. Although maternal body temperature during pregnancy was influenced by OSR, the variation in temperature was not great enough to affect litter sex ratios or any other phenotypic traits of the offspring.
Descriptors: lizards physiology, sex determination analysis, sex ratio, temperature, viviparity, nonmammalian.

Aranha, I., M. Bhagya, H.N. Yajurvedi, and B.K. Sagar (2004). **Light microscopical and ultrastructural studies on the vas deferens of the lizard *Mabuya carinata*.** *Journal of Submicroscopic Cytology and Pathology* 36(3-4): 247-256. ISSN: 1122-9497.
Abstract: Adult male lizards (*Mabuya carinata*) were studied during breeding and non breeding seasons to determine the regional and seasonal differences if any in the vas deferens

and to compare ultrastructural features of luminal epithelial cells with those of endotherms. The vas deferens of the lizard is a convoluted tube extending from the epididymis to the hemipenis passing over the kidney. Based on morphometric data of luminal diameter and epithelial cell height three distinct regions viz; proximal, middle and distal regions were identified in the vas deferens. The epithelium is surrounded by a thin layer of lamina propria, many layers of circular smooth muscle fibers and an outer layer of visceral pleuro peritoneum. Based on cell and nuclear morphology and ultrastructure, five different cell types viz; principal cell, basal cell, mitochondria rich cell, halo cell and narrow cell were identified in the epithelium during both breeding and non breeding season. Principal cells and basal cells were more abundant in both seasons. The types of luminal epithelial cells of vas deferens of *M. carinata* and their ultrastructural features are similar to those of mammals. Further, vas deferens of *M. carinata* differs from mammals in having only circular smooth muscles in contrast to circular and longitudinal muscles of mammalian vas deferens. To the best of our knowledge this is the first report describing cell types of vas deferens, their ultrastructure and ultrastructural seasonal variations in reptiles.
Descriptors: reptiles, lizards, anatomy, histology, vas deferens, ultrastructure , epididymis anatomy, epithelial cells ultrastructure, muscle, smooth, ultrastructure.

Belaid, B., H.N. Cong, G. Devilliers, N. Richard Mercier, C. Pieau, and M. Dorizzi (2004). **Lymphoid aggregates in gonads of embryos, hatchlings, and young of turtles with temperature-dependent sex determination.** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 301(2): 160-168. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Descriptors: turtles, gonads cytology, temperature, physiology, lymphocytes ultrastructure, electron microscopy, sex differentiation, anatomy, histology, turtles embryology.

Blackburn, D.G., A.R. Johnson, and J.L. Petzold (2003). **Placental ultrastructure in the brown snake *Storeria dekayi*.** *SICB Annual Meeting and Exhibition Final Program and Abstracts* 2003: 118. ISSN: print: 1540-7063; online: 1557-7023.
Descriptors: reptiles, brown snake, placental ultrastructure, meeting abstracts.
Notes: Meeting Information: Annual Meeting and Exhibition of the SICB (Society for Integrative and Comparative Biology), Toronto, ON, Canada; January 4-8, 2003.

Blackburn, D.G. and R.L. Lorenz (2003). **Placentation in garter snakes. II. Transmission EM of the chorioallantoic placenta of *Thamnophis radix* and *T. sirtalis*.** *Journal of Morphology* 256(2): 171-186. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: reptiles, garter snakes, placentation, transmission EM, chorioallantoic placenta, ultrastructure, allantoplacenta.

Blackburn, D.G. and R.L. Lorenz (2003). **Placentation in garter snakes. III. Transmission EM of the omphalallantoic placenta of *Thamnophis radix* and *T. sirtalis*.** *Journal of Morphology* 256(2): 187-204. ISSN: 0362-2525.

NAL Call Number: 444.8 J826
Descriptors: reptiles, garter snakes, placentation, transmission EM, omphalallantoic placenta.

Blackburn, D.G., J.R. Stewart, D.C. Baxter, and L.H. Hoffman (2002). **Placentation in garter snakes: scanning EM of the placental membranes of *Thamnophis ordinoides* and *T. sirtalis*.** *Journal of Morphology* 252(3): 263-275. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: reptiles, garter snakes, placentation, EM scanning, placental membranes, cross sections, uterine epithelium.

Broderick, A.C., F. Glen, B.J. Godley, and G.C. Hays (2003). **Variation in reproductive output of marine turtles.** *Journal of Experimental Marine Biology and Ecology* 288(1): 95-109. ISSN: 0022-0981.
NAL Call Number: QH91.A1J6
Descriptors: reptiles, marine turtles, reproductive output, variation, eggs laid per clutch, clutches per season, effects of environmental conditions.

Calderon, M.L., G.R. de Perez, and M.P. Ramirez Pinilla (2004). **Morphology of the ovary of *Caiman crocodilus* (Crocodylia: Alligatoridae).** *Annals of Anatomy* 186(1): 13-24. ISSN: 0940-9602.
Descriptors: reptiles, *Caiman crocodilus*, ovary, morphology, reproduction.

Carvalho, R.C., A.L. Sousa, C.E.B. Moura, T.N. Faria, W.P. Costa, H.R.A. Resende, H.M. Pereira, and A.N.B. Mariana (2003). **Morfologia do penis do jabuti de patas vermelhas (*Geochelone carbonaria* Spix, 1824). [Morphology of the penis of the red-footed tortoise (*Geochelone carbonaria* Spix, 1824)].** *Revista Brasileira De Reproducao Animal* 27(2): 229-230. ISSN: 0102-0803.
NAL Call Number: QP251.R48
Descriptors: reptiles, *Geochelone carbonaria*, anatomy, penis, reproduction, red footed tortoise, morphology, conference information.
Language of Text: Portuguese; Summary in English.
Notes: Meeting Information: XV Congresso Brasileiro de Repoducao Animal, Porto Seguro, Bahia, Brazil; August 11-15, 2003.

Centini, R. (2005). **Reproductive husbandry and problems of snakes.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 12: 37-39. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: reptiles, reproductive husbandry, problems, captivity, snakes, conference proceedings.

Chen, Q.S., L. Zhang, X.W. Chen, and X.K. Han (2006). **Ultrastructure of spermatozoon in soft-shelled turtle *Trionyx sinensis*.** *Acta Zoologica Sinica* 52(2): 415-423. ISSN: 0001-7302.
Descriptors: reptiles, soft shelled turtle, *Trionyx sinensis*, spermatazoon , ultrastructure.
Language of Text: Chinese; Summary in English.

Colli, G.R., R.D. Teixeira, D.M. Scheltinga, D.O. Mesquita, H.C. Wiederhecker, and S.N. Bao (2007). **Comparative study of sperm ultrastructure of five species of teiid lizards (Teiidae, Squamata), and *Cercosaura ocellata* (Gymnophthalmidae, Squamata).** *Tissue and Cell* 39(1): 59-78. ISSN: 0040-8166.
Abstract: Sperm ultrastructure of five teiid lizards (*Callopistes flavipunctatus, Crocodilurus amazonicus, Dicrodon guttulatum, Dracaena guianensis* , and *Teius oculatus*), and the gymnophthalmid *Cercosaura ocellata* is described for the first time. Comparisons of sperm ultrastructure among these species and with those of previously examined teiids and gymnophthalmids revealed that the two groups of Teiioidea (Gymnophthalmidae and Teiidae), and the two subfamilies of Teiidae (Teiinae and Tupinambinae) could be distinguished on the basis of sperm ultrastructure data. Significant differences in sperm dimensions between Cnemidophorus and Aspidoscelis support the recent splitting of these two lineages into different genera. Our results revealed high levels of inter-generic variability in sperm ultrastructure within Teiidae, which produces a data set useful in analyzing relationships between genera and families. In phylogenetic analyses, however, sampling multiple species within teiid genera is essential and recording sperm measurements may profitably complement qualitative ultrastructural characters, maximizing the information content of these structures.
Descriptors: reptiles, teiid lizards, sperm ultrastructure, comparative study, sperm dimensions, differences, inter-generic variability.

Cox, R.M. and H.B. John Alder (2005). **Testosterone has opposite effects on male growth in lizards (Sceloporus spp.) with opposite patterns of sexual size dimorphism.** *Journal of Experimental Biology.* 208(Pt 24): 4679-4687. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01948
NAL Call Number: 442.8 B77
Abstract: Sexual size dimorphism (SSD) has received considerable attention from evolutionary biologists, but relatively little is known about the physiological mechanisms underlying sex differences in growth that lead to SSD. Testosterone (T) stimulates growth in many male-larger vertebrates, but inhibits growth in the female-larger lizard *Sceloporus undulatus*. Thus, opposite patterns of SSD may develop in part because of underlying differences in the hormonal regulation of male growth. In the present study, we examined the effects of T on male growth in two sympatric congeners with opposite patterns of SSD (*S. virgatus*: female-larger; *S. jarrovii*: male-larger). During the mating season, yearling males of both species have higher plasma T levels than females, but whereas yearling males of *S. virgatus* grow only half as fast as females, yearling males of *S. jarrovii* grow more quickly than females. Thus, we hypothesized that T inhibits growth in yearling *S. virgatus* males, but promotes growth in yearling *S. jarrovii* males. In support of this hypothesis, we found that castrated (CAST) males of *S. virgatus* grew faster than castrated males given T implants (TEST). In contrast, TEST males of *S. jarrovii* grew faster than CAST males. Our results provide the first direct evidence for

opposite effects of T on male growth in closely related species with opposite patterns of SSD. We speculate that growth inhibition by T reflects an energetic trade-off between growth and reproductive investment, and propose that such ;costs' of male reproduction may help explain the evolution of female-larger SSD in Sceloporus.
Descriptors: lizards, Sceloporus spp., evolution, growth, development, drug effects, sex characteristics, testosterone, pharmacology, orchiectomy, species specificity, testosterone blood.

Cree, A., C.L. Tyrrell, M.R. Preest, D. Thorburn, and L.J. Guillette (2003). **Protecting embryos from stress: corticosterone effects and the corticosterone response to capture and confinement during pregnancy in a live-bearing lizard (*Hoplodactylus maculatus*).** *General and Comparative Endocrinology* 134(3): 316-329. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: Hormones in the embryonic environment, including those of the hypothalamo-pituitary-adrenal (HPA) axis, have profound effects on development in eutherian mammals. However, little is known about their effects in reptiles that have independently evolved viviparity. We investigated whether exogenous corticosterone affected embryonic development in the viviparous gecko *Hoplodactylus maculatus*, and whether pregnant geckos have a corticosterone response to capture and confinement that is suppressed relative to that in non-pregnant (vitellogenic) females and males. Corticosterone implants (5 mg, slow-release) administered to females in mid-pregnancy caused a large elevation of corticosterone in maternal plasma (P<0.001), probable reductions in embryonic growth and development (P=0.069-0.073), developmental abnormalities and eventual abortions. Cool temperature produced similar reductions in embryonic growth and development (P< or =0.036 cf. warm controls), but pregnancies were eventually successful. Despite the potentially harmful effects of elevated plasma corticosterone, pregnant females did not suppress their corticosterone response to capture and confinement relative to vitellogenic females, and both groups of females had higher responses than males. Future research should address whether lower maternal doses of corticosterone produce non-lethal effects on development that could contribute to phenotypic plasticity. Corticosterone implants also led to increased basking in pregnant females (P<0.001), and basal corticosterone in wild geckos (independent of reproductive condition) was positively correlated with body temperature (P<0.001). Interactions between temperature and corticosterone may have broad significance to other terrestrial ectotherms, and body temperature should be considered as a variable influencing plasma corticosterone concentrations in all future studies on reptiles.
Descriptors: reptiles, lizard, gecko, embryo stress, protecting, corticosterone, effects, response, capture, confinement, pregnancy.

Custodia Lora, N. and I.P. Callard (2002). **Progesterone and progesterone receptors in reptiles.** *General and Comparative Endocrinology* 127(1): 1-7. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: The role of progesterone (P) has been most extensively studied in the female reproductive tissues (ovary, reproductive tract, mammary gland) and in the brain, in which it is an important regulator and modulator in conjunction with estradiol (E). In nonmam-

malian vertebrate species, less work has been done on P metabolites involved in ovulation. In addition, P induces the expression of egg-white proteins, decreases myometrial contractility, and facilitates processing of eggs, formation of eggshell, and deposition of egg-white proteins. Actions of P may be synergistic with, or antagonist to, the actions of E, depending on hormone ratios, timing of exposure, and physiological state. These effects of P are mediated through progesterone receptor isoform A (PRA), a general transcription inhibitor of P target genes, and isoform B (PRB), a specific transcriptional stimulator of some reproductive tract genes. In this review, we focus on P action and PR expression in the liver and reproductive tissues of several reptilian species, especially Chelonia, since most of the data obtained are from this group. We also present novel data showing the expression of PR in nonreproductive tissues (such as kidney, spleen, gastrointestinal tract) in the painted turtle, *Chrysemys picta*.
Descriptors: reptiles, painted turtle, *Chrysemys picta*, progesterone, progesterone receptors, ovary, reproductive tract, brain, reproductive tissues.

Custodia Lora, N., A. Novillo, and I.P. Callard (2004). **Regulation of hepatic progesterone and estrogen receptors in the female turtle, *Chrysemys picta*: relationship to vitellogenesis.** *General and Comparative Endocrinology* 136(2): 232-240. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: Previous studies using the fresh water turtle *Chrysemys picta* have demonstrated the differential expression of the two progesterone receptor isoforms (PRA and PRB) in the liver during the turtle seasonal cycle, correlating with ER mRNA levels and hepatic vitellogenesis. During the inter-vitellogenic periods the ratio of PRB:PRA favors PRA, suggesting that the PRB:PRA ratio may be important in the regulation of vitellogenesis. Based on these and other studies we hypothesize that progesterone may have differential effects on the estrogen (E)-induced vitellogenin response (inhibitory or stimulatory), depending on the PRB:PRA ratio. In this study, we determined the expression pattern and the hormonal regulation of progesterone receptor (PR) isoforms in the liver, during the estrogen-induced vitellogenin response in female *C. picta*. Northern blot analysis was used to evaluate the changes in vitellogenin mRNA, estrogen receptor (ER) mRNA, and PR mRNA expression; Western blot to determine changes in PR isoform expression and a homologous ELISA for measurement of plasma vitellogenin. The expression of PR isoforms in the liver of female turtles at the mRNA and protein levels was differentially regulated by estradiol and progesterone. Estradiol treatment enhanced the transcription of PR mRNA isoforms and possibly translation and/or increased stability of PRB protein in the female turtle liver. In contrast, this hormone decreased PRA protein levels. Progesterone alone down-regulated progesterone receptor isoform A (PRA) and progesterone receptor isoform B (PRB) proteins equally, but did not affect PR mRNA levels. Estradiol markedly increased hepatic ER mRNA, vtg mRNA, and vtg in plasma, but this effect was not impacted significantly by progesterone. The results presented here indicate that in female turtles hepatic PRB:PRA ratios are markedly changed by estradiol treatment due primarily to a decrease in PRA. The change in the PRB:PRA ratio after hormonal treatment confirms that progesterone and estrogen exposure will be a determinant in the regulation of vitellogenesis, and, in turn, that the regulation of vitellogenesis will be determined by the ratio of PR isoforms and the physiological levels of steroid hormones.

Descriptors: reptiles, female painted turtle, hepatic progesterone, estrogen receptors, regulation, vitellogenesis.

de Solla, S.R., P.A. Martin, K.J. Fernie, B.J. Park, and G. Mayne (2006). **Effects of environmentally relevant concentrations of atrazine on gonadal development of snapping turtles (*Chelydra serpentina*).** *Environmental Toxicology and Chemistry* 25(2): 520-526. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Abstract: The herbicide atrazine has been suspected of affecting sexual development by inducing aromatase, resulting in the increased conversion of androgens to estrogens. We used snapping turtles (*Chelydra serpentina*), a species in which sex is dependent on the production of estrogen through aromatase activity in a temperature-dependent manner, to investigate if environmentally relevant exposures to atrazine affected gonadal development. Eggs were incubated in soil to which atrazine was applied at a typical field application rate (3.1 L/ha), 10-fold this rate (31 L/ha), and a control rate (no atrazine) for the duration of embryonic development. The incubation temperature (25 degrees C) was selected to produce only males. Although some males with testicular oocytes and females were produced in the atrazine-treated groups (3.3-3.7%) but not in the control group, no statistical differences were found among treatments. Furthermore, snapping turtle eggs collected from natural nests in a corn field were incubated at the pivotal temperature (27.5 degrees C) at which both males and females normally would be produced, and some males had oocytes in the testes (15.4%). The presence of low numbers of males with oocytes may be a natural phenomenon, and we have limited evidence to suggest that the presence of normal males with oocytes may represent a feminizing effect of atrazine. Histological examination of the thyroid gland revealed no effect on thyroid morphology.
Descriptors: turtles, atrazine toxicity, turtles growth, herbicides toxicity, oocytes growth and development, testis growth and development, turtles growth and development, aromatase biosynthesis, environmental exposure, enzyme induction, estrogens physiology, oocytes drug effects, ovum, temperature, testis cytology, testis drug effects.

Deeming, D.C. and G.F. Birchard (2007). **Allometry of egg and hatchling mass in birds and reptiles: roles of developmental maturity, eggshell structure and phylogeny.** *Journal of Zoology* 271(1): 78-87. ISSN: 0952-8369.
Abstract: The factors determining hatchling mass (HM) are investigated in a wide range of birds and reptiles using regression analysis, analysis of covariance and comparative analysis by independent contrasts. In birds, initial egg mass (IEM) at laying is the most important factor affecting HM and phylogenetic relatedness has no significant effects on HM. Developmental maturity of the avian neonates did not affect the proportion of IEM converted into HM. For all reptile species, IEM also significantly affected HM but phylogenetic relatedness did not. By contrast, allometric relationships between IEM and HM in the different orders of reptiles were affected by shell type. The robustness of allometric relationships across taxa in birds and reptiles suggests that there is a physiological link between IEM and HM, which contrasts with that observed for the relationship between egg mass and incubation period. This result has significant implications for the inter-relationships between IEM and embryonic growth, which are discussed for birds and reptiles.

Descriptors: reptiles, birds, egg hatchling mass, allometry, developmental maturity, eggshell structure , phylogeny.

DeNardo, D.F. (2004). **Essentials of reproductive physiology for the reptile practitioner**. *Proceedings of the North American Veterinary Conference* 18: 1333-1334. ISSN: 0341-6593.
NAL Call Number: SF605.N672
Descriptors: reptiles, reproductive physiology, essentials, reptile practitioner, conference proceedings, book chapter.
Notes: In the volume: Small Animal and Exotics Book Two: Pain Management Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Derby, A. (2005). **Elevage et reproduction en captivite du Cinosterne odorant, *Sternotherus odoratus*. [Rearing and captive reproduction of the musk turtle *Sternotherus odoratus*.]**. *Manouria* 8(26): 6-9. ISSN: 1422-4542.
Descriptors: reptiles, musk turtle, *Sternotherus odoratus*, rearing, captive reproduction.
Language of Text: French.

Doddamani, L.S. (2006). **Differentiation and development of testis in the oviparous lizard, *Calotes versicolor* (Daud.).** *Journal of Experimental Zoology Part A Comparative Experimental Biology* 305A(3): 299-308. ISSN: 1548-8969.
NAL Call Number: QL1.J854
Descriptors: reptiles, oviparous lizard, testis, development, differentiation, *Calotes versicolor*.

Du, W.G. and X. Ji (2002). **Effects of incubation temperature on duration of incubation. Hatching success, and hatching traits in the gray rat snake, *Ptyas korros* (Colubridae).** *Acta Ecologica Sinica* 22(4): 548-553. ISSN: 1000-0933.
Descriptors: reptiles, gray rat snake, *Ptyas korros*, incubation temperature, duration of incubation, hatching success.
Language of Text: Chinese; Summary in Chinese and English.

Eizaguirre, C., D. Laloi, M. Massot, M. Richard, P. Federici, and J. Clobert (2007). **Condition dependence of reproductive strategy and the benefits of polyandry in a viviparous lizard.** *Proceedings of the Royal Society of London. Series B, Biological Sciences* 274(1608): 425-430. ISSN: print: 0962-8452; online: 1471-2945.
Abstract: Species in which males do not contribute to reproduction beyond the provision of sperm offer good opportunities to study the potential genetic benefits that females can obtain from polyandry. Here, we report the results of a study examining the relationships between polyandry and components of female fitness in the common lizard (*Lacerta vivipara*). We found that polyandrous females produce larger clutches than monandrous females. Polyandrous females also lose fewer offspring during the later stages of gestation and at birth, but we did not find any relationship between polyandry and physical characteristics of viable neonates. Our results were consistent with the predictions of the intrinsic male quality hypothesis, while inbreeding avoidance and genetic incompatibility avoidance might also explain some part of the variation observed in clutch size. Moreover, the benefits of poly-

andry appeared to depend on female characteristics, as revealed by an interaction between reproductive strategy and female length on reproductive success. Thus, all females did not benefit equally from mating with multiple males, which could explain why polyandry and monandry coexist.
Descriptors: reptiles, viviparous lizard, reproductive strategy, polyandry, potential genetic benefits, female fitness, clutch size.

Elf, P.K. (2003). **Yolk steroid hormones and sex determination in reptiles with TSD.** *General and Comparative Endocrinology* 132(3): 349-355. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: In reptiles with temperature-dependent sex determination (TSD), the temperature at which the eggs are incubated determines the sex of the offspring. The molecular switch responsible for determining sex in these species has not yet been elucidated. We have examined the dynamics of yolk steroid hormones during embryonic development in the snapping turtle, *Chelydra serpentina*, and the alligator, *Alligator mississippiensis*, and have found that yolk estradiol (E(2)) responds differentially to incubation temperature in both of these reptiles. Based upon recently reported roles for E(2) in modulation of steroidogenic factor 1, a transcription factor known to be significant in the sex differentiation process, we hypothesize that yolk E(2) is a link between temperature and the gene expression pathway responsible for sex determination and differentiation in at least some of these species. Here we review the evidence that supports our hypothesis.
Descriptors: reptiles, snapping turtle, alligator, sex determination , incubation temperature, yolk steroid hormones, dynamics, embryonic development.

Elf, P.K., J.W. Lang, and A.J. Fivizzani (2002). **Dynamics of yolk steroid hormones during development in a reptile with temperature-dependent sex determination.** *General and Comparative Endocrinology* 127(1): 34-39. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: Many oviparous reptiles exhibit temperature-dependent sex determination (TSD); i.e., the temperature at which the egg is incubated determines the sex of the offspring. In TSD reptiles, yolk steroids not only may influence sex determination, but also may mediate hormonal effects on subsequent growth and behavior, as in some avian species. We investigated changes in the levels of estradiol (E(2)) and testosterone (T) during development in yolks of snapping turtle eggs, examined how incubation temperature affects hormone levels, and determined how hormones in turtle eggs are influenced by individual females (=clutch effects). Results indicate significant decreases in both hormones (>50% decline) by the end of the sex-determining period, when two-thirds of the development is complete. The declines in both E(2) and T were significantly affected by incubation temperature, but in different ways. Eggs incubated at female-producing temperatures maintained high levels, those incubated at male-producing temperatures had low E(2) values, and eggs incubated at pivotal temperatures had intermediate levels of E(2). At all three temperatures, T values underwent significant but approximately equal declines, except during the developmental stages just after the sex-determining period, when T levels decreased more at the male-producing temperature than at either of the other two temperatures. Initially, there were significant clutch

effects in both hormones, but such differences, attributable to individual females, were maintained only for E(2) later in development. Here we report for the first time that incubation temperature significantly affects the hormonal environment of the developing embryo of a turtle with temperature-dependent sex determination. Based on this and related findings, we propose that yolk sex steroids influence sexual differentiation in these TSD species and play a role in sex determination at pivotal temperatures.
Descriptors: reptiles, snapping turtle, egg yolk steroid hormones, sex determination, temperature dependent, development, incubation, testosterone analysis, turtle embryology.

Ezaz, T., N. Valenzuela, F. Grutzner, I. Miura, A. Georges, R.L. Burke, and J.A. Graves (2006). **An XX/XY sex microchromosome system in a freshwater turtle, *Chelodina longicollis* (Testudines: Chelidae) with genetic sex determination.** *Chromosome Research* 14(2): 139-150. ISSN: print: 0967-3849; online: 1573-6849.
NAL Call Number: QH600.C47
Abstract: Heteromorphic sex chromosomes are rare in turtles, having been described in only four species. Like many turtle species, the Australian freshwater turtle *Chelodina longicollis* has genetic sex determination, but no distinguishable (heteromorphic) sex chromosomes were identified in a previous karyotyping study. We used comparative genomic hybridization (CGH) to show that *C. longicollis* has an XX/XY system of chromosomal sex determination, involving a pair of microchromosomes. C-banding and reverse fluorescent staining also distinguished microchromosomes with different banding patterns in males and females in approximately 70% cells examined. GTG-banding did not reveal any heteromorphic chromosomes, and no replication asynchrony on the X or Y microchromosomes was observed using replication banding. We conclude that there is a very small sequence difference between X and Y chromosomes in this species, a difference that is consistently detectable only by high-resolution molecular cytogenetic techniques, such as CGH. This is the first time a pair of microchromosomes has been identified as the sex chromosomes in a turtle species.
Descriptors: fresh water turtle, *Chelodina longicollis*, sex chromosomes genetics, sex determination genetics, turtles genetics, chromosome banding, karyotyping, nucleic acid hybridization, sex differentiation, staining and labeling.

Fahrig, B.M., M.A. Mitchell, B.E. Eilts, and D.L. Paccamonti (2007). **Characterization and cooled storage of semen from corn snakes (*Elaphe guttata*).** *Journal of Zoo and Wildlife Medicine* 38(1): 7-12. ISSN: 1042-7260.
Abstract: The phylogenetic order Squamata has many representatives that could benefit from the use of semen preservation as a tool for assisting conservation. To date, few studies have been made evaluating the potential for collecting and preserving semen from snakes. The objectives of this study were to characterize semen parameters of the corn snake (*Elaphe guttata*), including appearance, volume, concentration, sperm motility, and sperm morphology, and to determine the longevity of corn snake sperm motility stored at 4 degrees C. Single semen samples were collected from 22 adult corn snakes. The appearance of the corn snake semen was generally cloudy, and the color was white to tan. Corn snake spermatozoa initially exhibited a median motility of 92.5%. Corn snakes were found to produce small-volume ejaculates (median 0.01 ml). However, the overall concentration of the snake

ejaculate was high (chi = 852 x 10(6) +/- 585 x 10(6) spermatozoa/ml). Morphologically, a mean of 75.7 +/- 9.3% of the sperm cells in an ejaculate were normal. Snake ejaculate with a white appearance had significantly higher sperm concentrations (chi = 1,859 x 10(6) +/- 1,008 x 106 sperm cells/ml; F = 15.74, P = 0.001) than tan ejaculates (chi = 601 x 10(6) +/- 439 x 106 sperm cells/ml). Sperm motility decreased significantly in samples that were stored at 4 degrees C for greater than 48 hr in a refrigerator or Equitainer I. This is the first study to characterize semen volume, appearance, and concentration; sperm motility; and sperm morphology in captive corn snakes. The information derived from this study can be used to develop a model for a collection, cooled storage, and shipping program for semen from endangered or threatened captive and wild snakes.
Descriptors: reptiles, corn snakes, *Elaphe guttata*, cooled storage semen, characterization, semen preservation, sperm morphology, shipping, conservation.

Ferreira, A. and H. Dolder (2003). **Sperm ultrastructure and spermatogenesis in the lizard, *Tropidurus itambere*.** *Biocell* 27(3): 353-362. ISSN: 0327-9545.
Abstract: Spermatogenesis, with emphasis on spermiogenesis, is described for the lizard, *Tropidurus itambere*, using light microscopy, phase contrast and epifluorescence, as well as scanning and transmission electron microscopy. Cellular differentiation involves events of chromatin condensation, nuclear elongation and the formation of structural complexes, such as the acrosomal and axonemal ones. Other new characteristics, exclusive for this species, include various aspects of the subacrosomal granule, the insertion of the pro-acrosomal vesicle and the development of these structures to participate in the acrosomal complex. Radial projections occurjust above the nuclear shoulders, which have been recognized already from the beginning of cellular elongation. The development of the midpiece, the dense bodies, formation of the flagellum and elimination of residual cytoplasm result in the final characterization of the mature spermatozoon. Comparisons between Tropiduridae and other lizard families are made.
Descriptors: reptiles, lizard, *Tropidurus itambere*, sperm ultrastructure, spermatogenesis.

Ferreira, A. and H. Dolder (2002). **Ultrastructural analysis of spermiogenesis in *Iguana iguana* (Reptilia: Sauria: Iguanidae).** *European Journal of Morphology* 40(2): 89-99. ISSN: print: 0924-3860; online: 1744-4241.
Abstract: Spermiogenesis in the lizard, *Iguana iguana*, was studied by transmission and scanning electron microscopy. During this process, structures such as the acrosomal complex in the spermatid head and the axonemal complex in the mid and principal pieces of the flagellum are formed. The nuclear content is initially compacted into thick, longitudinal chromatin filaments. Nuclear shape is determined by further compaction and by the manchette, a layer of microtubules surrounding the head. The acrosomal complex originates from Golgi vesicles and the interaction between the proacrosomal vesicle and the nucleus. The midpiece consists of a pair of centrioles, surrounded by a fibrous sheath and rings of simple and modified mitochondria. The centrioles sustain the axoneme that appears at the end of the midpiece. The axoneme extends throughout the principal piece of the flagellum with the 9 + 2 pattern, still surrounded by the fibrous sheath. In the endpiece, the axoneme continues, surrounded only by the plasma membrane. In the lumen of seminiferous tubules, immature

spermatozoa retain abundant residual cytoplasm.
Descriptors: reptiles, *Iguana*, spermiogenesis, ultrastructureal analysis, scanning electron microscopy.

Gaibazzi, G. (2005). **Elevage et reproduction de la platemyde de l'Amazone, *Batrachemys raniceps* (Gray, 1855). [Rearing and reproduction of the turtle *Batrachemys raniceps* (Gray, 1855).].** *Manouria* 8(27): 27-32. ISSN: 1422-4542.
Descriptors: reptiles, turtle, *Batrachemys raniceps*, reproduction, captive breeding, rearing.
Language of Text: French.

Gal, J., M. Mandoki, E. Sos, and M. Marosan (2004). **Tojasvisszatartas es kovetkezmenyes savosfibrines savoshartya-gyulladas vitorlas agama (*Hydrosaurus amboinensis*) testuregeben. [Egg retention and consequent catarrhal-fibrinoid inflammation of serous membrane in a sailfin lizard's (*Hydrosaurus amboinensis*) abdominal cavity].** *Magyar Allatorvosok Lapja* 126(5): 290-292. ISSN: 0025-004X.
Descriptors: reptiles, sailfin lizard, *Hydrosaurus amboinensis*, egg retention, reproductive disorders, serous membrane, inflammation, abdominal cavity.
Language of Text: Hungarian; Summary in English.

Ganesh, C.B. and H.N. Yajurvedi (2002). **Stress inhibits seasonal and FSH-induced ovarian recrudescence in the lizard, *Mabuya carinata*.** *Journal of Experimental Zoology.* 292(7): 640-648. ISSN: print: 0022-104X; online: 1097-010X.
NAL Call Number: 410 J825
Descriptors: reptiles, lizard, *Mabuya carinata*, stress, inhibits, FSH induced, ovarian recrudescence.

Gao, Z.f. (2005). **Observation on behavior and reproduction of some reptiles under artificial breeding condition.** *Sichuan Journal of Zoology* 24(2): 180. ISSN: 1000-7083.
Descriptors: reptiles, reproduction, observation, artificial breeding condition, behavior.
Language of Text: Chinese.

Gartrell, B.D., J.E. Girling, A. Edwards, and S.M. Jones (2002). **Comparison of noninvasive methods for the evaluation of female reproductive condition in a large viviparous lizard, *Tiliqua nigrolutea*.** *Zoo Biology* 21(3): 253-268. ISSN: 0733-3188.
NAL Call Number: QL77.5.Z6
Descriptors: reptiles, viviparous lizards, *Tiliqua nigrolutea*, zoo animals, gestation period, ovulation, radiography, ultrasonography, ovarian follicles, accuracy, pregnancy diagnosis, females, palpation, ultrasonic diagnosis, ultrasonic devices, diagnostic value.

Gilland, E.H. and A.C. Burke (2004). **Gastrulation in reptiles.** In: C.D. Stern (Editor), *Gastrulation: From Cells to Embryo,* Cold Spring Harbor Laboratory Press.: Cold Spring Harbor, NY, p. 205-217. ISBN: 0879697075.
NAL Call Number: QL955 .G34 2004
Descriptors: reptiles, gastrulation, cells , embryo.

Girling, J.E., S.M. Jones, and R. Swain (2002). **Delayed ovulation and parturition in a viviparous alpine lizard (*Niveoscincus microlepidotus*): morphological data and plasma steroid concentrations.** *Reproduction, Fertility, and Development* 14(1-2): 43-53. ISSN: 1031-3613.
NAL Call Number: QP251.R47
Abstract: The southern snow skink, *Niveoscincus microlepidotus*, exhibits an unusual biennial reproductive cycle with an extended gestation period of approximately 1 year. Morphological data were gathered on a monthly basis, providing a detailed picture of the reproductive cycle. Vitellogenesis begins in spring, immediately after parturition. Maximum follicular diameter is reached before the winter hibernation period and ovulation occurs the following spring. Embryos are fully developed and reach maximum size by early autumn. Yolk reserves are depleted before winter. Birth of between one and four young occurs the following spring. Plasma progesterone concentrations are low (2.7 +/- 0.9 ng mL(-1)) in post-partum females, begin to rise in autumn in vitellogenic females and peak (38.5 +/- 7.9 ng mL(-1)) in pre-ovulatory females after hibernation. Concentrations are high (15.4 +/- 5.9 ng mL(-1)) in early pregnancy and decline to basal levels before winter and well before birth in spring. Plasma oestradiol concentrations peak during vitellogenesis (1.0 +/- 0.3 ng mL(-1)) and decline to basal levels during pregnancy (0.2 +/- 0.03 ng mL(-1)). A second oestradiol peak occurs before parturition (0.7 +/- 0.2 ng mL(-1)). Thus, functional completion of vitellogenesis and gestation is achieved by autumn in successive years. The mechanisms that defer ovulation and parturition by a further six months are unknown.
Descriptors: reptiles, snow skink, *Niveoscincus microlepidotus*, delayed ovulation, parturition , alpine lizard, *Niveoscincus microlepidotus*, plasma steroid concentrations, reproductive cycle.

Girondot, M., P. Rivalan, R. Wongsopawiro, J.P. Briane, V. Hulin, S. Caut, E. Guirlet, and M.H. Godfrey (2006). **Phenology of marine turtle nesting revealed by statistical model of the nesting season**. *BMC Ecology* 6: 11. ISSN: 1472-6785.
Online: http://dx.doi.org/10.1186/1472-6785-6-11
Descriptors: reptiles, marine turtle, nesting, phenology, statistical model, nesting season, eggs, mathematical model.

Gist, D.H., S. Bradshaw, C.M. Morrow, J.D. Congdon, and R.A. Hess (2007). **Estrogen response system in the reproductive tract of the male turtle: an immunocytochemical study.** *General and Comparative Endocrinology* 151(1): 27-33. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: Portions of the reproductive tract of the male (*Trachemys scripta*) turtle were examined by immunocytochemistry for evidence of the capacity to produce and respond to estrogen hormones (via the expression of P450 aromatase and estrogen receptors). Aromatase was detected in both the Sertoli and Leydig cells of the testis and was expressed at different levels during the spermatogenic cycle, being highest in the quiescent testis and lowest during germ cell meiosis. ERalpha was found in the Leydig cells surrounding the seminiferous tubules as well as in the epithelial cells of the excurrent canals (rete testis, efferent ductule, and epididymis). ERbeta immunoreactivity was found in both the spermatogonia and Sertoli cells in the testis, and in the epithelial cells of excurrent canals.

Descriptors: reptiles, male turtle, *Trachemys scripta*, estrogen response system, reproductive tract, estrogen hormones, leydig cells, sertoli and Leydig cells, testis.

Gist, D.H., S.M. Dawes, T.W. Turner, S. Sheldon, and J.D. Congdon (2002). **Sperm storage in turtles: A male perspective.** *Journal of Experimental Zoology.* 292(2): 180-186. ISSN: print: 0022-104X; online: 1097-010X.
NAL Call Number: 410 J825
Descriptors: reptiles, turtles, sperm storage, male perspective.

Giugliano, L.G., R.D. Teixeira, G.R. Colli, and S.N. Bao (2002). **Ultrastructure of spermatozoa of the lizard *Ameiva ameiva*, with considerations on polymorphism within the family Teiidae (Squamata).** *Journal of Morphology* 253(3): 264-271. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: reptiles, lizard, *Ameiva ameiva*, spermatozoa, ultrastructure, polymorphism, family Teiidae.

Godfrey, M.H. and N. Mrosovsky (2006). **Pivotal temperature for green sea turtles, *Chelonia mydas*, nesting in Suriname.** *Herpetological Journal* 16(1): 55-61. ISSN: 0268-0130.
Descriptors: reptiles, green sea turtles, *Chelonia mydas*, pivotal temperature, sexual differentiation, nesting, Surinam.

Goldberg, S.R. (2006). **Reproductive cycle of the spotted sand lizard, *Pedioplanis lineoocellata* (Squamata: Lacertidae) from southern Africa.** *Texas Journal of Science* 58(1): 65-72. ISSN: 0040-4403.
Descriptors: reptiles, spotted sand lizard, *Pedioplanis lineoocellata*, reproductive cycle, southern Africa.

Goldberg, S.R. (2006). **Reproductive cycle of the Namaqua sand lizard, *Pedioplanis namaquensis* (Squamata: Lacertidae), from southern Africa.** *African Zoology* 41(1): 147-149. ISSN: 1562-7020.
NAL Call Number: QL336.Z6
Descriptors: reptiles, Namaqua sand lizard, *Pedioplanis namaquensis*, reproductive cycle, southern Africa.

Goldberg, S.R. (2006). **Note on reproduction of the striped sandveld lizard, *Nucras tessellata* (squamata : lacertidae) from southern africa**. *Bulletin of the Maryland Herpetological Society* 42(3): 137-139. ISSN: 0025-4231.
NAL Call Number: QL640.M3
Descriptors: reptiles, striped sandveld lizard, *Nucras tessellata*, reproduction, note, Africa.

Goldberg, S.R. (2006). **Reproductive cycle of the bushveld lizard *Heliobolus lugubris* (Squamata : Lacertidae) from southern africa**. *Salamandra* 42(2-3): 151-154. ISSN: 0036-3375.
Descriptors: reptiles, bushveld lizard, reproductive cycle, sperm formation, prolonged period , testicular cycle, multiple clutches.

Gray, R.L. (2003). ***Desert Lizards: Captive Husbandry and Propagation***, Malabar, USA: Krieger Publishing Company, 130 p. ISBN: 1575241699.
Descriptors: reptiles, desert lizards, care, captive husbandry, propagation.

Gribbins, K.M., D.H. Gist, and J.D. Congdon (2003). **Cytological evaluation of spermatogenesis and organization of the germinal epithelium in the male slider turtle, *Trachemys scripta*.** *Journal of Morphology* 255(3): 337-346. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: reptiles, male slider turtle, *Trachemys scripta*, spermatogenesis, germinal epithelium, cytological evaluation, *Trachemys scripta.*

Gribbins, K.M. and D.H. Gist (2003). **Cytological evaluation of spermatogenesis within the germinal epithelium of the male european wall lizard, *Podarcis muralis*.** *Journal of Morphology* 258(3): 296-306. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: reptiles, European wall lizard, *Podarcis muralis*, spermatogenesis, cytological evaluation, germinal epithelium.

Gribbins, K.M., C.S. Happ, and D.M. Sever (2005). **Ultrastructure of the reproductive system of the black swamp snake (*Seminatrix pygaea*). V. The temporal germ cell development strategy of the testis.** *Acta Zoologica Copenhagen* 86(4): 223-230. ISSN: 0001-7272.
Descriptors: reptiles, *Seminatrix pygaea*, black swamp snake, reproductive system, ultrastructure, temporal germ cell development, testis.

Guerrero, S.M., M.L. Calderon, G.R. de Perez, and M.P.R. Pinilla (2004). **Morphology of the male reproductive duct system of *Caiman crocodilus* (Crocodylia, Alligatoridae).** *Annals of Anatomy* 186(3): 235-245. ISSN: 0940-9602.
Descriptors: reptiles, crocodile, alligator, *Caiman crocodilus*, male, reproductive duct system, morphology.

Hammouche, S., T. Gernigon, and J.M. Exbrayat (2006). **[beta]-endorphine et activite ovarienne chez un lezard deserticole, *Uromastyx acanthinura*. [[beta]-endorphin and ovarian activity in a desert lizard, *Uromastyx acanthinura*.].** *Bulletin De La Societe Zoologique De France* 131(1): 5-10. ISSN: 0037-962X.
Descriptors: reptiles, desert lizard, *Uromastyx acanthinura*, endorphin, ovarian activity, reproductive function, breeding.
Language of Text: French; Summary in English and French.

Harms, H.K., R.T. Paitz, R.M. Bowden, and F.J. Janzen (2005). **Age and season impact resource allocation to eggs and nesting behavior in the painted turtle.** *Physiological and Biochemical Zoology* 78(6): 996-1004. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Theory predicts that in long-lived organisms females should invest less energy in reproduction and more in growth and self-maintenance early in life, with this balance shifting as females age and the relative value of each reproductive event increases. We investigated

this potential trade-off by characterizing within-population variation in resource allocation to eggs by female painted turtles (*Chrysemys picta*) and relating this variation to their nesting ecology and life history. We examined lipid and protein allocation to yolks, accounting for both relative female age and seasonal effects (first vs. second clutches within a female). Older females appear to increase their investment in reproduction by producing larger eggs, but these eggs are not disproportionately more lipid or protein rich than the smaller eggs from younger females. Within the nesting season, first clutches have more lipid and protein than second clutches. We also found that younger females nest closer to the water than older females. Our results indicate that trade-offs involving resource allocation and nesting behavior do occur both seasonally and with age, suggesting ontogenetic variation in life-history strategies in this long-lived organism.
Descriptors: reptiles, painted turtle, *Chrysemys picta*, nesting behavior, age, season, eggs, resource allocation, impact , reproduction, energy.

Hernandez Franyutti, A., M.C. Uribe Aranzabal, and L.J.J. Guillette (2005). **Oogenesis in the viviparous matrotrophic lizard *Mabuya brachypoda*.** *Journal of Morphology* 265(2): 152-164. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: lizards, physiology, oogonia physiology, vitellogenesis physiology, chromosomes, ultrastructure, cytoplasm physiology, ultrastructure, egg yolk physiology, ultrastructure, anatomy, histology, ovulation physiology.

Hua, T.m., C.l. Wang, and B.h. Chen (2004). **Stages of embryonic development for *Alligator sinensis*.** *Zoological Research* 25(3): 263-271. ISSN: 0254-5853.
Online: http://www.bioline.org.br/abstract?id=zr04046&lang=en
NAL Call Number: QL1.T85
Descriptors: reptiles, *Alligator sinensis*, embryonic, development, stages, alligators, crocodiles.
Language of Text: Chinese; Summary in Chinese and English.

Ibarguengoytia, N.R. and L.M. Casalins (2007). **Reproductive biology of the southernmost gecko *Homonota darwini*: convergent life-history patterns among southern hemisphere reptiles living in harsh environments**. *Journal of Herpetology* 41(1): 72-80. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: reptiles, southernmost gecko, *Homonota darwini*, reproductive biology, harsh environments, life history patterns, reproductive cycles, seasons.

Isberg, S.R., P.C. Thomson, F.W. Nicholas, S.G. Barker, and C. Moran (2005). **Quantitative analysis of production traits in saltwater crocodiles (*Crocodylus porosus*): I. reproduction traits.** *Zeitschrift Fur Tierzuchtung Und Zuchtungsbiologie. [Journal of Animal Breeding and Genetics]* 122(6): 361-369. ISSN: 0931-2668.
NAL Call Number: 442.8 Z35
Abstract: Repeatability and phenotypic correlations were estimated for saltwater crocodile reproductive traits. No pedigree information was available to estimate heritability or genetic

correlations, because the majority of breeder animals on farms were wild-caught. Moreover, as the age of the female breeders could not be accounted for, egg-size measurements were used as proxies. The reproductive traits investigated were clutch size (total number of eggs laid), number of viable eggs, number of eggs that produced a live, healthy hatchling, hatchability, average snout-vent length of the hatchlings and time of nesting. A second data set was also created comprising binary data of whether or not the female nested. Repeatability estimates ranged from 0.24 to 0.68 for the measurable traits, with phenotypic correlations ranging from -0.15 to 0.86. Repeatability for whether a female nested or not was 0.58 on the underlying scale. Correlations could not be estimated between the measurement and binary traits because of confounding. These estimates are the first published for crocodilian reproduction traits.

Descriptors: alligators, crocodiles, *Crocodylus porosus*, growth, development, animal husbandry methods, breeding methods, fertility physiology, reproduction physiology, age factors, body weights, measures, clutch size, ovum cytology, reproduction traits.

Isberg, S.R., P.C. Thomson, F.W. Nicholas, S.G. Barker, and C. Moran (2006). **Quantitative analysis of production traits in saltwater crocodiles (*Crocodylus porosus*): III. juvenile survival.** *Zeitschrift Fur Tierzuchtung Und Zuchtungsbiologie. [Journal of Animal Breeding and Genetics].* 123(1): 44-47. ISSN: 0931-2668.

NAL Call Number: 442.8 Z35

Abstract: Mortality records of 1302 juvenile crocodiles were available for analysis. Crocodiles that were slaughtered during this study were treated as censored (n = 2151). Additionally, records from animals that had neither died nor been slaughtered, i.e. were still alive in the production system (n = 1582), were censored at the last date of data collection. There were a total of 3733 censored records. The data were all full-sib records from 29 parental pairs from Janamba Croc Farm (Northern Territory, Australia), collected over nine consecutive years. Data were analysed using an extension of Cox's proportional hazards model to include frailty (random) terms to account for genetic effects. Heritability of log survival time for juvenile crocodile survival was 0.15 (SE 0.04). The probability of a juvenile crocodile surviving to day 400 was estimated to be only 51%. These results are the first to quantify juvenile survival in a captive breeding situation. Also, this is the first heritability estimate of crocodile survival and is a fundamental element in the development of a genetic improvement programme.

Descriptors: alligators, crocodiles, *Crocodylus porosus*, genetics, growth, development, breeding methods, mortality, risk factors.

Isberg, S.R., P.C. Thomson, F.W. Nicholas, G.J. Webb, S.C. Manolis, S.G. Barker, and C. Moran (2006). **Quantitative analysis of production traits in saltwater crocodiles (*Crocodylus porosus*): IV. number of scale rows.** *Zeitschrift Fur Tierzuchtung Und Zuchtungsbiologie. [Journal of Animal Breeding and Genetics].* 123(1): 48-55. ISSN: 0931-2668.

NAL Call Number: 442.8 Z35

Abstract: A total of 3156 scale row records, comprising 1739 full-sibling records from 30 families from Janamba Croc Farm (NT, Australia) and 1417 parent-offspring records from 19 families from Wildlife Management International, Pty Ltd (NT, Australia), collected at each

facility using a different method, were analysed using ASReml. The full-sibling heritability estimate for the Janamba data was 0.37 (SE 0.03). The animal model estimate of heritability for the Wildlife Management International (WMI) data, also based predominantly on full-sibling data, was 0.42 (SE 0.04). The counts from three counting methods were evaluated by regression analysis on 100 individuals and were found to be highly correlated. Using the regression relationship, the WMI data were transformed and pooled with the Janamba data to give an animal model heritability estimate of 0.42 (SE 0.04). A multitrait analysis revealed negligible correlations (both phenotypical and genetical) between hatchling size traits and the number of scale rows. There is ample genetic variation to incorporate this trait into a genetic improvement programme for farmed saltwater crocodiles.
Descriptors: alligators, crocodiles, *Crocodylus porosus*, genetics, growth, development, anatomy, histology, body weights, measures, breeding.

Iverson, J.B. (2002). **Reproduction in female razorback musk turtles (*Sternotherus carinatus*: kinosternidae)**. *Southwestern Naturalist* 47(2): 215-224. ISSN: 0038-4909.
NAL Call Number: 409.6 So8
Descriptors: reptiles, female razorback musk turtle, *Sternotherus carinatus*, reproduction.

Janssen, C. (2003). **Artificial incubation of turtle eggs**. *Exotic DVM* 5(5): 11-12. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, turtle eggs, artificial incubation, dehydration, fetal development, humidity, incubators, temperature.

Kamelin, E.R. and Yu.A. Lukin (2005). **Sperm storage in two species of snakes: Asian pit vipers *Trimeresurus albolabris* (Gray, 1842) and *Trimeresurus erythrurus* (Cantor, 1839), bred at the Leningrad Zoo terrarium.** *Russian Journal of Herpetology* 12(Suppl.): 158-160. ISSN: 1026-2296.
Descriptors: reptiles, snakes, sperm storage, Asian pit vipers, *Trimeresurus albolabris*, *Trimeresurus erythrurus*, Leningrad Zoo.

Katsu, Y., J. Myburgh, S. Kohno, G.E. Swan, L.J.J. Guillette, and T. Iguchi (2006). **Molecular cloning of estrogen receptor alpha of the Nile crocodile.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 143(3): 340-346. ISSN: 1095-6433.
Abstract: Estrogens are essential for normal reproductive activity in female and male vertebrates. In female reptiles, they are essential for ovarian differentiation during a critical developmental stage. To understand the molecular mechanisms of estrogen action in the Nile crocodile (*Crocodylus niloticus*), we have isolated cDNA encoding the estrogen receptor alpha (ERalpha) from the ovary. Degenerate PCR primers specific to ER were designed and used to amplify Nile crocodile cDNA from the ovary. The full-length Nile crocodile ERalpha cDNA was obtained using 5' and 3' rapid amplification cDNA ends (RACE). The deduced amino acid sequence of the Nile crocodile ERalpha showed high identity to the American alligator ERalpha (98%), caiman ER (98%), lizard ER (82%) and chicken ERalpha (92%), although phylogenetic analysis suggested profound differences in the rate of sequence evolution for vertebrate ER sequences. Expression of ERalpha was observed in the ovary and testis of juve-

nile Nile crocodiles. These data provide a novel tool allowing future studies examining the regulation and ontogenic expression of ERalpha in crocodiles and expands our knowledge of estrogen receptor evolution.
Descriptors: alligators, amino acid sequence, base sequence, gonads metabolism, molecular sequence data, phylogeny , tertiary protein structure, sequence alignment, Nile crocodile, *Crocodylus niloticus*, molecular cloning, alpha estrogen receptor.

Khalifa, S.A. (2003). **Comparative ultrastructure study on spermiogenesis in two lizards, *Tarentola annularis* and *Agama stellio*.** *Journal of Union of Arab Biologists Cairo A Zoology* 20: 29-40. ISSN: 1110-5372.
Descriptors: reptiles, lizards, *Agama stellio*, *Tarentola annularis*, spermatogenesis, comparative ultrastructure study.
Language of Text: Arabic; English.

Knapp, C.R., J.B. Iverson, and A.K. Owens (2006). **Geographic variation in nesting behavior and reproductive biology of an insular iguana (*Cyclura cychlura*)**. *Canadian Journal of Zoology* 84(11): 1566-1575. ISSN: 0008-4301.
NAL Call Number: 470 C16D
Descriptors: reptiles , insular iguana, *Cyclura cychlura*, nesting behavior, reproductive biology, geographic variation, environmental factors.

Koehler, G., V. Haecky and B. Eidenmuller (2005). ***Incubation of Reptile Eggs: Basics, Guidelines, Experiences***, Krieger Publishing Company: Malabar, FL, 214 p. ISBN: 1575241935.
Descriptors: reptiles, incubation of eggs, basic care, guidelines, reptiles as pets.
Notes: Translation of: Inkubation von Reptilieneiern, translated by Valerie Haecky.

Kohno, S., B.C. Moore, M.P. Gunderson, T.A. Bryan, and L.J.J. Guillette (2006). **Androgen receptor in the female reproductive tract of the American alligator, *Alligator mississippiensis*.** *Biology of Reproduction*(Sp. Iss. SI): 118-119. ISSN: 0006-3363.
Descriptors: reptiles, American alligator, *Alligator mississippiensis*, female reproductive tract, androgen receptor, meeting.
Notes: Meeting Information: 39th Annual Meeting of the Society for the Study of Reproduction, Omaha, NE, USA; July 29 -August 1, 2006.

Krohmer, R.W. (2004). **The male red-sided garter snake (*Thamnophis sirtalis parietalis*): reproductive pattern and behavior.** *ILAR Journal* 45(1): 54-74. ISSN: print: 1084-2020; online: 0018-9960.
Online: http://dels.nas.edu/ilar_n/ilarjournal/45_1/html/v4501krohmer.shtml
NAL Call Number: QL55.A1I43
Abstract: Among the small group of species (e.g., some temperate zone turtles, snakes, and bats) that exhibit a dissociated reproductive pattern, the red-sided garter snake (*Thamnophis sirtalis parietalis*) is probably the most well studied. For these species, courtship and mating occur immediately upon emergence from winter dormancy; the gonads remain essentially inactive. Male red-sided garter snakes are a particularly informative animal model for

examining the role of neuroendocrine factors associated with reproductive physiology and behavior because unlike species that exhibit an associated reproductive pattern, in which sex steroids initiate and control sexual behavior, reproductive behavior in the male garter snake appears to be independent of circulating sex hormone control. In fact, the only factor associated with the initiation of courtship behavior and mating in the male garter snake is an extended period of low temperature dormancy followed by exposure to warm temperatures. Yet the presence of sex steroid-concentrating neurons within the pathways regulating courtship and mating suggests that sex hormones may be involved in the activation of sexual behavior. Although circulating androgens are elevated upon emergence from hibernation, the initiation of courtship behavior and mating appears to be independent of direct androgen control. Thus steroid hormones may have indirect effects on mating behavior in animals that display "dissociated" reproductive behaviors.
Descriptors: red-sided garter snake, *Thamnophis sirtalis parietalis*, male, reproductive pattern, behavior, courtship, mating, gonads, reproductive behavior, steroid hormones.

Krohmer, R.W., D. Martinez, and R.T. Mason (2004). **Development of the renal sexual segment in immature snakes: effect of sex steroid hormones.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 139(1): 55-64. ISSN: 1095-6433.
Abstract: The renal sexual segment (RSS) of immature Northern and Diamondback Water Snakes and Red-Sided Garter Snakes exhibited varying responses to testosterone or 17beta-estradiol. In both male and female water snakes, kidney mass was not a reliable indicator of hormone treatment, whereas tubule diameter, epithelial height and number of sexual granules responded to hormone treatment. In male water snakes, either hormone initiated granule development by day 16; by day 23, only testosterone increased granule density. Female water snakes receiving either hormone exhibited a small number of granules by day 16; by day 23, granules increased only in Diamondback Water Snakes receiving testosterone. Hormones did not initiate RSS hypertrophy in female Red-Sided Garter Snakes. Tubule diameter and epithelial height of testosterone-treated males exhibited significant hypertrophy, while 17beta-estradiol initiated significant increases in tubule diameter. Garter snakes initiated sexual granule development in response to hormone treatment with males exhibiting a greater response than females and testosterone stimulating a greater response than 17beta-estradiol. Sex steroids appear to mimic sexual maturity in immature snakes initiating RSS development. Whereas the RSS of adult males respond to testosterone, our data suggest specific changes in the RSS of females during maturation effectively negates the effect of 17beta-estradiol evident in immature female RSS.
Descriptors: reptiles, immature snakes, renal sexual segment , development, sex steroids, effect.

Krysko, K.L. (2003). **Reproduction in the madagascar leaf-nosed snake, *Langaha madagascariensis* (Serpentes: Colubridae: Pseudoxyrhophiinae).** *African Journal of Herpetology* 52(1): 61-68. ISSN: 0441-6651.
Descriptors: reptiles, madagascar leafe nosed snake, reproduction.

Krysko, K.L., C.M.I. Sheehy, and a.N. Hooper (2003). **Interspecific communal oviposition and reproduction of four species of lizards (Sauria: Gekkonidae) in the lower Florida Keys.** *Amphibia Reptilia* 24(3): 390-396. ISSN: 0173-5373.
Descriptors: reptiles, lizards, four species, reproduction, communal oviposition, Florida Keys.

Kuchling, G. (2006). **Endoscopic sex determination in juvenile freshwater turtles, *Erymnochelys madagascariensis*: morphology of gonads and accessory ducts.** *Chelonian Conservation and Biology* 5(1): 67-73. ISSN: 1071-8443.
Descriptors: reptiles, fresh water turtles, *Erymnochelys madagascariensis*, endoscopic sex determination, juvenile, gonads, accessory ducts, morphology.

Ladyman, M., X. Bonnet, O. Lourdais, D. Bradshaw, and G. Naulleau (2003). **Gestation, thermoregulation, and metabolism in a viviparous snake, *Vipera aspis*: evidence for fecundity-independent costs.** *Physiological and Biochemical Zoology* 76(4): 497-510. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Oxygen consumption of gestating Aspic vipers, *Vipera aspis* (L.), was strongly dependent on body temperature and mass. Temperature-controlled, mass-independent oxygen consumption did not differ between pregnant and nonpregnant females. Maternal metabolism was not influenced during early gestation by the number of embryos carried but was weakly influenced during late gestation. These results differ from previous investigations that show an increase in mass-independent oxygen consumption in reproductive females relative to nonreproductive females and a positive relationship between metabolism and litter size. These data also conflict with published field data on *V. aspis* that show a strong metabolic cost associated with reproduction. We propose that, under controlled conditions (i.e., females exposed to precise ambient temperatures), following the mobilisation of resources to create follicles (i.e., vitellogenesis), early gestation per se may not be an energetically expensive period in reproduction. However, under natural conditions, the metabolic rate of reproductive females is strongly increased by a shift in thermal ecology (higher body temperature and longer basking periods), enabling pregnant females to accelerate the process of gestation. Combining both laboratory and field investigation in a viviparous snake, we suggest that reproduction entails discrete changes in the thermal ecology of females to provide optimal temperatures to the embryos, whatever their number. This results in the counterintuitive notion that metabolism may well be largely independent of fecundity during gestation, at least in an ectothermic reptile.
Descriptors: reptiles, viviparous snake, *Vipera aspis*, gestation, thermoregulation, metabolism, fecundity, body temperature, oxygen consumption.

LeMaster, M.P. and R.T. Mason (2002). **Variation in a female sexual attractiveness pheromone controls male mate choice in garter snakes.** *Journal of Chemical Ecology* 28(6): 1269-1285. ISSN: print: 0098-0331; online: 1573-1561.
Abstract: Male red-sided garter snakes (*Thamnophis sirtalis parietalis*) display a courtship preference for larger females during the breeding season. Utilizing behavioral experiments

and chemical analyses, we tested the hypothesis that males can discriminate among females of varying size solely by means of the sexual attractiveness pheromone, a previously characterized sex pheromone composed of a homologous series of long-chain saturated and omega-9 cis-unsaturated methyl ketones contained in the skin lipids of females. When presented with skin lipid extracts from large and small females, a greater proportion of males displayed courtship behaviors to large female extracts. This demonstrates that there is an intrinsic property of the female skin lipids that allows males to differentiate among large and small females. Analysis of the sexual attractiveness pheromone revealed that the necessary variation exists for this pheromone to function as a reliable indicator to males of female body size. Specifically, we observed a strong correlation between female snout-vent length and the relative concentration of saturated and omega-9 cis-unsaturated methyl ketones composing the pheromone; smaller females expressed pheromone profiles higher in saturated methyl ketones. while larger females expressed pheromone profiles dominated by unsaturated methyl ketones. The results of this study suggest that male red-sided garter snakes utilize compositional variation in the female sexual attractiveness pheromone to differentiate among potential mates of varying size.

Descriptors: reptiles, garter snakes, *Thamnophis sirtalis parietalis*, female sexual attractiveness, variation, pheromone controls, mate choice, preference for larger females.

Lewis, W.G.V. (2003). **Dystocia in a tortoise**. *Exotic DVM* 5(1): 14. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, dystocia, tortoise, case reports, clinical aspects, diagnosis, surgical operations.

Litzgus, J.D. (2006). **Sex differences in longevity in the Spotted Turtle (*Clemmys guttata*).** *Copeia* 2006(2): 281-288. ISSN: 0045-8511.
Descriptors: reptiles, spotted turtle, *Clemmys guttata*, sex differences, longivity, egg, hatching rate, survival.

Litzgus, J.D. and T.A. Mousseau (2006). **Geographic variation in reproduction in a freshwater turtle (*Clemmys guttata*).** *Herpetologica* 62(2): 132-140. ISSN: 0018-0831.
NAL Call Number: QL640.H4
Descriptors: reptiles, freshwater turtle, *Clemmys guttata*, reproduction, geographic variation.

Mader, D.R. (2002). **Reproductive surgery in the green iguana.** *Proceedings of the North American Veterinary Conference* 16(16): 923-924. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, Iguana, ovariectomy, ovulation, females, surgery, reproductive, meeting.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida.

Mahmoud, I.Y., J.R. Paulson, M. Dudley, J.S. Patzlaff, and A.Y. Al Kindi (2004). **Secretory proteins in the reproductive tract of the snapping turtle, *Chelhydra serpentina*.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 139(4): 487-494. ISSN: 1095-6433.

Abstract: SDS-polyacrylamide gel electrophoresis was used to separate the secretory proteins produced by the epithelial and endometrial glands of the uterine tube and uterus in the snapping turtle *Chelydra serpentina*. The proteins were analyzed throughout the phases of the reproductive cycle from May to August, including preovulatory, ovulatory, postovulatory or luteal, and vitellogenic phases. The pattern of secretory proteins is quite uniform along the length of the uterine tube, and the same is true of the uterus, but the patterns for uterine tube and uterus are clearly different. We identify 13 major proteins in *C. serpentina* egg albumen. Bands co-migrating with 11 of these are found in the uterine tube, but at most 4 are found in the uterus, suggesting that the majority of the albumen proteins are most likely secreted in the uterine tube, not in the uterus. Although some of the egg albumen proteins are present in the uterine tube only at the time of ovulation, most of the bands corresponding to albumen proteins are present throughout the breeding season even though the snapping turtle is a monoclutch species. These results suggest that the glandular secretory phase in the uterine tube is active and quite homogeneous in function regardless of location or phase of the reproductive cycle.

Descriptors: reptiles, snapping turtle, *Chelydra serpentina*, secretory proteins, reproductive tract, reproductive cycle.

Martinez Torres, M., M. Elena Hernandez Caballero, C. Alvarez Rodriguez, J. Alba Luis Diaz , and G. Ortiz Lopez (2003). **Luteal development and progesterone levels during pregnancy of the viviparous temperate lizard *Barisia imbricata imbricata* (Reptilia: Anguidae).** *General and Comparative Endocrinology* 132(1): 55-65. ISSN: 0016-6480.

NAL Call Number: 444.8 G28

Abstract: The relationship between plasma progesterone (P(4)) levels and the formation and degeneration of the corpus luteum (CL) was assessed monthly during gestation of the viviparous lizard *Barisia imbricata imbricata*. Histochemical activity of the delta(5-4) isomerase 3 beta-hydroxysteroide dehydrogenase (delta(5-4)3beta-HSD) in the luteal tissue and embryonic development were also observed. Females were gravid throughout winter and great part of spring (late November or early December until late May or early June). Corpus luteum development occurred in the first third of gestation (December and January) when the embryo reached developmental stage 27. Four sequential stages were identified during development and three stages during regression of the CL. The follicular and thecal tissue participated in the formation of the luteal cell mass. According to Xavier's classification, the CL of B. i. imbricata is a subtype from Type III. The activity of delta(5-4)3beta-HSD was observed mainly in the luteal cell mass. The first degenerative changes in the CL were observed in the early second third of the gestation and continued gradually until parturition. Progesterone levels increased in early pregnancy and reached its highest level during January (3.07+/-1.04 ng/ml) when mature corpora lutea were present. Gradual diminution in progesterone concentrations occurred in the second and last third of pregnancy and coincided with advanced degenerative changes and diminution in histochemical activity of delta(5-

4)3beta-HSD in the luteal tissue. These observations suggest that the CL is the major source of progesterone during pregnancy of *B. i. imbricata.*
Descriptors: reptiles , lizard, *Barisia imbricata imbricata*, pregnancy, luteal development, progesterone levels, corpus luteum, gestation, embryo.

Masunaga, G. and H. Ota (2003). **Growth and reproduction of the sea snake, *Emydocephalus ijimae*, in the central Ryukyus, Japan: a mark and recapture study.** *Zoological Science* 20(4): 461-470. ISSN: 0289-0003.
NAL Call Number: QL1.Z68
Abstract: A mark and recapture study was carried out for three years on a population of the Ijima's sea snake, *Emydocephalus ijimae*, in the coastal shallow water of Zamamijima Island, central Ryukyus, Japan. The relatively high recapture (47% of 167 marked snakes) suggests that *E. ijimae* is a particularly philopatric, sedentary species among the sea snakes. The sex ratio (male: female), approximately 1.6:1, significantly skewed from 1:1. The growth rate in SVL declined with growth, with females thoroughly growing better than males. Males and females were estimated to begin reproductive activity in the second or third summer and the third spring after birth, respectively. Frequency of female reproduction is guessed to vary from annual to biennial, or even less frequent.
Descriptors: reptiles, sea snake, *Emydocephalus ijimae*, growth, reproduction, recapture study, Japan.

Mattson, J.K., A.T. Devries, S.M. Mcguire, J. Krebs, E.E. Louis, and N.M. Loskutoff (2007). **Successful artificial insemination in the corn snake (*Elaphe gutatta*), using fresh and cooled semen**. *Reproduction, Fertility, and Development* 19(1): 240. ISSN: 1031-3613.
NAL Call Number: QP251.R47
Descriptors: reptiles, corn snake, artificial insemination, fresh cooled semen.
Notes: Meeting Information: 33rd Annual Conference of the Internatinal Embryo Transfer Society, Kyoto, Japan; January 6-10, 2007.

Mendonca, M.T., D. Daniels, C. Faro, and D. Crews (2003). **Differential effects of courtship and mating on receptivity and brain metabolism in female red-sided garter snakes (*Thamnophis sirtalis parietalis*).** *Behavioral Neuroscience* 117(1): 144-149. ISSN: 0735-7044.
NAL Call Number: QP351.B45
Abstract: In the female red-sided garter snake (*Thamnophis sirtalis parietalis*), the loss of receptivity following intromission during mating can be prevented by injection of a local anesthetic (tetracaine) in the cloacal region prior to courtship and mating. Females that were courted and then mated had significantly higher uptake of radio-labeled [14C]2-fluoro-2-deoxyglucose (2-DG) in the preoptic area (25%) and significantly lower uptake in the ventromedial hypothalamus (-20%) compared with females that were courted but not mated. Tetracaine-treated females had accumulation patterns similar to courted but unmated females and to females exposed only to other females. These results suggest that in the female red-sided garter snake, sensory input from the cloaca during mating alters patterns of metabolism in those brain areas most often associated with female sexual behavior.

Descriptors: reptiles, red-sided garter snakes, *Thamnophis sirtalis parietalis*, courtship, mating recptivity effects, brain metabolism, female, local anesthetic.

Mitchell, M.A., T.W. Adamson, C.B. Singleton, M.K. Roundtree, R.W. Bauer, and M.J. Acierno (2007). **Evaluation of a combination of sodium hypochlorite and polyhexamethylene biguanide as an egg wash for red-eared slider turtles (*Trachemys scripta elegans*) to suppress or eliminate *Salmonella* organisms on egg surfaces and in hatchlings.** *American Journal of Veterinary Research* 68(2): 158-164. ISSN: 0002-9645.
NAL Call Number: 41.8 Am3A
Abstract: OBJECTIVE: To evaluate a combination of 2 nonantibiotic microbicide compounds, sodium hypochlorite (NaOCl) and polyhexamethylene biguanide (PHMB), as a treatment to suppress or eliminate *Salmonella* spp from red-eared slider (RES) turtle (*Trachemys scripta elegans*) eggs and hatchlings. SAMPLE POPULATION: 2,738 eggs from 8 turtle farms in Louisiana. PROCEDURES: Eggs were randomly sorted into 3 or, when sufficient eggs were available, 4 treatment groups as follows: control, pressure-differential egg treatment with NaOCl and gentamicin, NaOCl and PHMB bath treatment, and pressure-differential egg treatment with NaOCl and PHMB. Bacterial cultures were performed from specimens of eggs and hatchlings and evaluated for *Salmonella* spp. RESULTS: RES turtle eggs treated with NaOCl and PHMB as a bath (odds ratio [OR], 0.2 [95% confidence interval (CI), 0.1 to 0.3]) or as a pressure-differential dip (OR, 0.01 [95% CI, 0.001 to 0.07]) or with gentamicin as a pressure-differential dip (OR, 0.1 [95% CI, 0.06 to 0.2]) were significantly less likely to have *Salmonella*-positive culture results than control-group eggs. CONCLUSIONS AND CLINICAL RELEVANCE: Concern over reptile-associated salmonellosis in children in the United States is so great that federal regulations prohibit the sale of turtles that are < 10.2 cm in length. Currently, turtle farms treat eggs with gentamicin solution. Although this has reduced *Salmonella* shedding, it has also resulted in antimicrobial resistance. Results of our study indicate that a combination of NaOCl and PHMB may be used to suppress or eliminate *Salmonella* spp on RES turtle eggs and in hatchlings.
Descriptors: reptiles , red eared slider turtles, *Trachemys scripta elegans*, sodium hypochlorite, polyhexamethylene, egg wash, *Salmonella* organisms, hatchlings.

Mubarak, M. (2006). **Ultrastructure of sperm tail differentiation of the lizard *Stenodactylus dorie* (Squamata, Reptilia).** *Journal of Biological Sciences* 6(1): 187-192. ISSN: 1727-3048.
Online: http://ansijournals.com/3/detail.php?id=1&jid=jbs&theme=3&issueno=165&articleno=55270
NAL Call Number: QH301.J687
Descriptors: reptiles, lizard, *Stenodactylus dorie*, sperm tail differentiation, ultrastructural study.

Munns, S. and C. Daniels (2007). **Breathing with big babies: ventilation and oxygen consumption during pregnancy in the lizard *Tiliqua rugosa*.** *Physiological and Biochemical Zoology* 80(1): 35-45. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: We determined the effects of high gestational loads on ventilation and the rate

of oxygen consumption (VO2) in the scincid lizard *Tiliqua rugosa*. *Tiliqua rugosa* is a large viviparous lizard that gives birth to one to four young after 6-7 mo gestation. Pregnant females gave birth to large young, weighing 89.5+/-5.9 g, which represents 21.6%+/-2.6% of maternal body mass. As the embryos developed, they occupied an increasingly large proportion of the body cavity, decreasing food consumption and compressing the gastrointestinal tract. Computerized axial tomography scans demonstrated that the lungs were compressed and/or regionally collapsed by the developing embryos, potentially compromising ventilation. Both minute ventilation (VE) and tidal volume decreased as gestation progressed, but no compensatory changes in breathing frequency or in the duration of the nonventilatory period were observed. The total rate of VO2, consisting of contributions from both maternal and fetal tissues, did not change during gestation, suggesting that maternal VO2 decreases as fetal VO2 increases. Pregnant females demonstrated a decreased ventilatory response to increased respiratory drive (triggered via inhalation of hypoxic hypercapnic gas), which may be associated with the increased energetic cost of ventilating a compressed lung or the desensitization of chemoreceptors during gestation. The decreased ability of the respiratory system to respond to increased respiratory drive may have important consequences for locomotor performance and predator avoidance in pregnant lizards.
Descriptors: reptiles, lizards, *Tiliqua rugosa*, oxygen consumption, ventilation, pregnancy, gestational loads, effects, large young, birth.

Nakamura, M. (2004). **[Sex determination in reptiles and amphibians: with special reference to the mechanism of temperature-dependent sex determination]**. *Tanpakushitsu Kakusan Koso; Protein, Nucleic Acid, Enzyme* 49(2): 124-129. ISSN: 0039-9450.
Descriptors: amphibian, reptiles, embryology, embryology, sex determination genetics, temperature, amphibian genetics, androgens physiology, dna binding proteins genetics, physiology, estrogens physiology, fushi tarazu transcription factors, gene expression, gonads embryology, high mobility group proteins genetics, physiology, homeodomain proteins, receptors, cytoplasmic, nuclear, reptiles genetics, sex chromosomes genetics, sex reversal, transcription factors genetics, transcription factors physiology.
Language of Text: Japanese.

Orrell, K.S., J.D. Congdon, T.A. Jenssen, R.H. Michener, and T.H. Kunz (2004). **Intersexual differences in energy expenditure of *Anolis carolinensis* lizards during breeding and postbreeding seasons.** *Physiological and Biochemical Zoology* 77(1): 50-64. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Although the amount of energy that males and females invest in reproduction is an integral component of theories explaining the evolution of particular mating strategies, few studies have actually determined the amount of energy that each sex allocates to reproduction. We compared how energy is expended by male and female *Anolis carolinensis* lizards during both the breeding and postbreeding seasons. We used laboratory respirometry to determine resting metabolic rates (RMRs) of inactive, freshly captured lizards and the doubly labeled water technique to determine field metabolic rates (FMRs) of free-ranging lizards. Both RMRs and FMRs were influenced by body mass but not by sex. Season did not influ-

ence FMRs; however, RMRs of both sexes increased approximately 40% from the breeding to the postbreeding season. The seasonal increase in RMRs was attributed to a postreproductive increase in feeding rate and specific dynamic action. We used RMRs, FMRs, and thermal profiles of lizards to calculate energy budgets for breeding and postbreeding seasons. Energy budgets partitioned daily field energy (DFE; calculated from FMRs) into daily activity energy (DAE) and daily resting energy (DRE; calculated from RMRs). Energy expended for reproduction was estimated as DAE during the breeding season plus egg production (for females). Despite males having 40% greater body mass, females expended 46% more energy for reproduction than did males (906 and 619 J/d, respectively). Total metabolizable energy (TME=DFE+egg production for females) expended during the breeding season was similar for males and females (1,280 and 1,365 J/d, respectively). Although TME of females decreased 44% from the breeding to the postbreeding season (1,365 vs. 766 J/d), TME of males was similar during both seasons (1,280 vs. 1,245 J/d). There were both seasonal and sexual differences in DRE and DAE. Compared with most lizards from semiarid/desert habitats, *A. carolinensis* in a temperate habitat expends more total energy during the breeding season, allocates more energy to eggs, and appears to have more total energy available for reproduction.
Descriptors: reptiles, lizards, *Anolis carolinensis*, breeding, postbreeding seasons, energy expenditure, intersexual differences, reproduction, energy budgets.

Painter, D., D.H. Jennings, and M.C. Moore (2002). **Placental buffering of maternal steroid hormone effects on fetal and yolk hormone levels: a comparative study of a viviparous lizard, *Sceloporus jarrovi*, and an oviparous lizard, *Sceloporus graciosus*.** *General and Comparative Endocrinology* 127(2): 105-116. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: reptiles, viviparous and oviparous lizards, placental buffering, maternal steroid hormone, effects, fetal, yolk, hormone levels, comparative study.

Pieau, C. and M. Dorizzi (2004). **Oestrogens and temperature-dependent sex determination in reptiles: All is in the gonads.** *Journal of Endocrinology* 181(3): 367-377. ISSN: 0022-0795.
Online: http://dx.doi.org/10.1677/joe.0.1810367
NAL Call Number: 448.8 J8293
Abstract: In many species of oviparous reptiles, the first steps of gonadal sex differentiation depend on the incubation temperature of the eggs. Feminization of gonads by exogenous oestrogens at a male-producing temperature and masculinization of gonads by antioestrogens and aromatase inhibitors at a female-producing temperature have irrefutably demonstrated the involvement of oestrogens in ovarian differentiation. Nevertheless, several studies performed on the entire gonad/adrenal/mesonephros complex failed to find differences between male- and female-producing temperatures in oestrogen content, aromatase activity and aromatase gene expression during the thermosensitive period for sex determination. Thus, the key role of aromatase and oestrogens in the first steps of ovarian differentiation has been questioned, and extragonadal organs or tissues, such as adrenal, mesonephros, brain or yolk, were considered as possible targets of temperature and sources of the oestrogens acting on gonadal sex differentiation.In disagreement with this view, experiments and assays carried

out on the gonads alone, i.e. separated from the adrenal/mesonephros, provide evidence that the gonads themselves respond to temperature shifts by modifying their sexual differentiation and are the site of aromatase activity and oestrogen synthesis during the thermosensitive period. Oestrogens act locally on both the cortical and the medullary part of the gonad to direct ovarian differentiation. We have concluded that there is no objective reason to search for the implication of other organs in the phenomenon of temperature-dependent sex determination in reptiles. From the comparison with data obtained in other vertebrates, we propose two main directions for future research: to examine how transcription of the aromatase gene is regulated and to identify molecular and cellular targets of oestrogens in gonads during sex differentiation, in species with strict genotypic sex determination and species with temperature-dependent sex determination.
Descriptors: reptiles, sex determination, gonads, estrogens, temperture dependent, incubation temperature.

Pleguezuelos, J.M. and M. Feriche (2006). **Reproductive ecology of a Mediterranean ratsnake, the ladder snake *Rhinechis scalaris* (schinz, 1822)**. *Herpetological Journal* 16(2): 177-182. ISSN: 0268-0130.
Descriptors: reptiles, rat snake, ladder snake, *Rhinechis scalaris*, reproductive ecology, newborn size, prey size, hibernation.

Radder, R.S., B.A. Shanbhag, and S.K. Saidapur (2004). **Yolk partitioning in embryos of the lizard, *Calotes versicolor*: maximize body size or save energy for later use?** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 301(9): 783-785. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Abstract: The hatchlings of *Calotes versicolor* and other congeners retain residual yolk for immediate post-hatching needs. Excision of 8% yolk (approximately equal residual yolk) from the eggs resulted in smaller hatchlings when compared to those emerging from sham operated eggs. However, hatchlings in both groups retained the same amount of residual yolk. The findings suggest that residual yolk in hatchlings of *C. versicolor* is an important part of the energy budget set aside by developing embryos and that the advantages of large hatchling size are counter balanced by selection for residual yolk.
Descriptors: reptiles, lizard, *Calotes versicolor*, partitioning in embryos, maximize body size, energy use, hatchlings, yolk partitioning, residual yolk.

Ramirez Bautista, A., C.A. Maciel Mata, and M.A. Martinez Morales (2005). **Reproductive cycle of the viviparous lizard *Sceloporus grammicus* (Squamata: phrynosomatidae) from Pachuca, Hidalgo, Mexico.** *Acta Zoologica Sinica* 51(6): 998-1005. ISSN: 0001-7302.
Descriptors: reptiles, viviparous lizard, *Sceloporus grammicus*, reproductive cycle, breeding season, Mexico.
Language of Text: Chinese; English.

Ramirez Bautista, u. (2003). **Some reproductive characteristics of a tropical arid lizard assemblage from Zapotitlan Salinas, Puebla, Mexico.** *Herpetological Review* 34(4): 328-331. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, tropical lizard, reproductive characteristics, Mexico.

Ramirez Sandoval, E., A. Ramirez Bautista, and L.J. Vitt (2006). **Reproduction in the lizard *Phyllodactylus lanei* (Squamata: Gekkonidae) from the Pacific Coast of Mexico.** *Copeia* 2006(1): 1-9. ISSN: 0045-8511.
Descriptors: reptiles, lizard, *Phyllodactylus lanei*, reproduction, biology, Pacific coast, Mexico.
Language of Text: English; Spanish.

Rivas, J.A. and G.M. Burghardt (2005). **Snake mating systems, behavior, and evolution: the revisionary implications of recent findings.** *Journal of Comparative Psychology* 119(4): 447-454 . ISSN: 0735-7036.
Descriptors: green anacondas snake, mating systems, behavior, evolution, behavior , recent findings, polygny.

Russo, M., G. Troncone, F.M. Guarino, F. Angelini, and P. Chieffi (2005). **Estrogen-induced Akt-1 activity in the lizard (*Podarcis s. sicula*) testis.** *Molecular Reproduction and Development* 71(1): 52-57. ISSN: 1040-452X.
NAL Call Number: QP251.M64
Descriptors: reptiles, lizard, *Podarcis s. sicula*, testis, estrogen induced Akt-1, activity, reproduction, mating.

Sakata, J.T., S.C. Woolley, A. Gupta, and D. Crews (2003). **Differential effects of testosterone and progesterone on the activation and retention of courtship behavior in sexual and parthenogenetic whiptail lizards.** *Hormones and Behavior* 43(5): 523-530. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Abstract: Both testosterone (T) and progesterone (P) facilitate the expression of male-typical sexual behavior in a variety of animals, including rodents and lizards. In two species of whiptail lizards, *Cnemidophorus inornatus* and *C. uniparens*, both hormones elicit the full repertoire of courtship behavior. However, the relative efficacy of the two hormones is unknown. In Experiments 1 and 2 we assessed differences in capacity of exogenous T and P to induce male-typical courtship behavior in gonadectomized whiptail lizards. In both species, individuals implanted with T showed more frequent courtship behavior relative to those implanted with P or cholesterol. In Experiments 3 and 4 we examined whether T and P differentially affected the retention of courtship behavior following implant removal. In both species, individuals implanted with T showed more courtship behavior following implant removal than those previously given P. In these experiments, implants were removed at a time when individuals in both groups were behaviorally similar; therefore, the differences in behavior following implant removal were not due to differences in the amount of courtship experience. Taken together, the hormone that was more effective at activating courtship

behavior was also more effective at maintaining courtship behavior following implant removal. In summary, though both T and P can elicit identical sexual behaviors in both whiptail species, T has a greater and more lasting effect on courtship behavior and possibly on the neural circuits underlying courtship behavior.
Descriptors: reptiles, whiptail lizards, *Cnemidophorus inornatus* and *C. uniparens*, courtship, behavior, testosterone, progesterone, differential effects, activation, retention.

Sarkar, S., N.K. Sarkar, and B.R. Maiti (2003). **Oviductal sperm storage structure and their changes during the seasonal (dissociated) reproductive cycle in the soft-shelled turtle *Lissemys punctata punctata*.** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 295(1): 83-91. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Descriptors: reptiles, soft shelled turtle , *Lissemys punctata punctata*, oviductal sperm, storage stucture, seasonal changes.

Schmidt de Aguiar, L.F. and M. Di Bernardo (2005). **Reproduction of the water snake *Helicops infrataeniatus* (Colubridae) in southern Brazil.** *Amphibia Reptilia* 26(4): 527-533. ISSN: 0173-5373.
Descriptors: reptiles, water snake, *Helicops infrataeniatus*, reproduction, Brazil.

Schmidt, D. (2004). **Zur Reproduktion von Schlangen im Terrarium Aufgaben - Fakten - Probleme. [The reproduction of snakes in the terrarium. Duties - facts - problems.]**. *Draco* 5(1): 22-36 Nr 17. ISSN: 1439-8168.
Descriptors: reptiles, snakes, reproduction, terrarium, facts, duties, problems.
Language of Text: German.

Selcer, K.W., S. Smith, J.W. Clemens, and B.D. Palmer (2005). **Androgen receptor in the oviduct of the turtle, *Trachemys scripta*.** *Comparative Biochemistry and Physiology. Part B, Biochemistry and Molecular Biology* 141(1): 61-70. ISSN: 1096-4959.
Abstract: Circulating androgens reach high concentrations in females of some reptiles and amphibians. We are testing the hypothesis that androgens can act directly in female reptilian reproductive tissues, via the androgen receptor. In this study, we sought to determine if androgen receptors are present in the oviduct of the turtle, *Trachemys scripta*, using radioligand-binding assays and immunological assays. An androgen-binding site was detected in turtle oviductal cytosol and oviductal nuclear extract by radioligand binding assay, using (3) H-dihydrotestosterone (DHT) as the ligand. This site was saturable (B(max)=11 pmol/g tissue), had a high affinity (10(-10) M), and showed specificity typical of androgen receptors (DHT>testosterone, progesterone>>estradiol, cortisol). Western blotting using an anti-androgen receptor antibody revealed a band of immunoreactivity in oviductal cytosol at approximately 115 kDa, and a more prominent band at 50 kDa, possibly indicating a truncated form of the androgen receptor. Immunohistochemistry revealed crossreactivity of the androgen receptor antibody against oviductal glandular cells but not against oviductal luminal epithelial or muscularis cells. The presence of androgen receptor in the turtle oviduct suggests that androgens have a role in female reproduction and that their action can be medi-

ated directly by androgen receptor.
Descriptors: turtle, *Trachemys scripta*, oviduct, androgen receptor, reproductive tissues, androgen receptor, female reproduction, assay.

Sever, D.M. (2004). **Ultrastructure of the reproductive system of the black swamp snake (*Seminatrix pygaea*). IV. Occurrence of an ampulla ductus deferentis.** *Journal of Morphology* 262(3): 714-730. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Abstract: The distal end of the ductus deferens of *Seminatrix pygaea* (Cope) differs from more proximal portions of the tube by possessing a highly fluctuated epithelium. Similar morphology has been reported in this area in one lizard and some mammals and the region has been designated in these taxa as the ampulla ductus deferentis. In this study, light and transmission electron microscopy were used to study the posterior ductus deferens in *S. pygaea* and compare the histology in this region to more proximal regions of the duct and to descriptions of the ampulla of other species. *Seminatrix pygaea* stores sperm throughout the ductus deferens during the entire year. The epithelium of the ductus deferens is not secretory, but the presence of numerous small apical vesicles indicates a role in fluid absorption. In addition to the highly folded epithelium, clusters of sperm nuclei are more intimately associated with the apical ampullary epithelium than elsewhere in the ductus deferens. No evidence of phagocytosis of sperm was found. In contrast, the ampulla of mammals and presumably the lizard *Calotes versicolor* is glandular and phagocytic. The common character shared by the squamates and mammals with specializations in this area is the folded epithelium, and whether this is due to shared ancestry with amniotes or is homoplastic is unresolved.
Descriptors: reptiles, black swamp snake, *Seminatrix pygaea*, lizard, *Calotes versicolor*, reproductive system, ultrastructure, ampulla ductus deferentis.

Sever, D.M. and W.C. Hamlett (2002). **Female sperm storage in reptiles.** *Journal of Experimental Zoology* 292(2): 187-199. ISSN: print: 0022-104X; online: 1097-010X.
NAL Call Number: 410 J825
Descriptors: reptiles, fertilization, oviducts, female sperm storage, reptiles physiology, vagina anatomy.

Sever, D.M., R.A. Stevens, T.J. Ryan, and W.C. Hamlett (2002). **Ultrastructure of the reproductive system of the black swamp snake (*Seminatrix pygaea*). III. Sexual segment of the male kidney.** *Journal of Morphology* 252(3): 238-254. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: reptiles, black swamp snake, *Seminatrix pygaea*, reproductive system, ultrastructure, male kidney, sexual segment.

Shanbhag, B.A., S.K. Saidapur, and R.S. Radder (2003). **Lowering body temperature induces embryonic diapause during prolonged egg retention in the lizard, *Calotes versicolor*.** *Die Naturwissenschaften* 90(1): 33-35. ISSN: print: 0028-1042; online: 1432-1904.
Abstract: The lizard *Calotes versicolor* delays oviposition of oviductal eggs for as long as 6

months or more under unfavourable conditions. During this period of prolonged egg retention, the growth of oviductal embryos is arrested at stage 34. The present study shows for the first time among reptiles that the "embryonic diapause" is manifested by the gravid females by lowering their body temperature (T(b)) by 3-5 degrees C during the period of egg retention by mechanism(s) presently unknown.
Descriptors: reptiles, lizard, *Calotes versicolor*, prolonged egg retention, body temperature, lowering, embryonic diapause.

Shanbhag, B.A. (2003). **Reproductive strategies in the lizard, *Calotes versicolor*.** *Current Science* 84(5): 646-652. ISSN: 0011-3891.
Descriptors: reptiles, lizard, *Calotes versicolor*, reproductive strategies.

Shanbhag, B.A. (2002). **Reproductive biology of Indian reptiles.** *PINSA B* 68(6): 497-528. ISSN: 0073-6600.
Descriptors: reptiles, Indian, reproductive biology.
Notes: PINSA-B (Proceedings of the Indian National Science Academy, Part-B) Special issue devoted to Stress Response.

Shine, R. (2003). **Reproductive strategies in snakes.** *Proceedings of the Royal Society of London. Series B, Biological Sciences* 270(1519): 995-1004. ISSN: 0080-4649.
Abstract: Snakes of both sexes display remarkable flexibility and diversity in their reproductive tactics. Many features of reproduction in female snakes (such as reproductive mode and frequency, seasonality and multiple mating) allow flexible maternal control. For example, females can manipulate not only the genotypes of their offspring (through mate choice or enhanced sperm competition) but also the phenotypes of their offspring (through allocation 'decisions', behavioural and physiological thermoregulation, and nest-site selection). Reliance on stored energy ('capital') to fuel breeding results in low frequencies of female reproduction and, in extreme cases, semelparity. A sophisticated vomeronasal system not only allows male snakes to locate reproductive females by following scent trails, but also facilitates pheromonally mediated mate choice by males. Male-male rivalry takes diverse forms, including female mimicry and mate guarding; combat bouts impose strong selection for large body size in males of some species. Intraspecific (geographical) variation and phenotypic plasticity in a wide array of reproductive traits (offspring size and number; reproductive frequency; incidence of multiple mating; male tactics such as mate guarding and combat; mate choice criteria) provide exceptional opportunities for future studies.
Descriptors: reptiles, snakes, reproductive strategies, tactics, multiple mating, thermoregulation, vermonasal system.

Shine, R., T. Langkilde, and R.T. Mason (2003). **Cryptic forcible insemination: male snakes exploit female physiology, anatomy, and behavior to obtain coercive matings.** *American Naturalist* 162(5): 653-667. ISSN: 0003-0147.
NAL Call Number: 470 Am36
Abstract: Whether males can inseminate uncooperative females is a central determinant of mating system evolution that profoundly affects the interpretation of phenomena such

as multiple mating by females, mate choice, reproductive seasonality, and courtship tactics. Forcible insemination is usually inferred from direct physical battles between the sexes and has been dismissed on intuitive grounds for many kinds of animals. For example, snakes have elongate flexible bodies (making it difficult for a male to restrain a female physically), males are typically smaller than females, and copulation requires female cloacal gaping to enable intromission. Male garter snakes (*Thamnophis sirtalis*) do not display any overt aggression during courtship and simply lie over the female and exhibit rhythmic pulsating caudocephalic waves of muscular contraction; previous studies have interpreted this behavior as a mechanism for eliciting female receptivity. In contrast, we show that male garter snakes forcibly inseminate females. They do so by taking advantage of specific features of snake physiology, respiratory anatomy, and antipredator behavior. The snake lung extends along most of the body, with the large posterior section (the saccular lung) lacking any respiratory exchange surface. Rhythmic caudocephalic waves by courting male garter snakes push anoxic air from the saccular lung forward and across the respiratory surfaces such that females cannot obtain oxygen. Their stress response involves cloacal gaping, which functions in other contexts to repel predators by extruding feces and musk but in this situation permits male intromission. Thus, superficially benign courtship behaviors may involve cryptic coercion even in species for which intuition dismisses any possibility of forcible insemination.
Descriptors: reptiles, male snakes, garter snakes, *Thamnophis sirtalis*, forcible insemination, female, physiology, anatomy, behavior, matings.

Staljanssens, P. and J. Nijs (2002). **Captive care and reproduction of the common snapping turtle, *Chelydra s. serpentina*.** *Podarcis* 3(2): 34-42. ISSN: 1567-3871.
Descriptors: reptiles, common snapping turtle, *Chelydra serpentina*, captive care, reproduction.

Stewart, J.R. and K.R. Brasch (2003). **Ultrastructure of the placentae of the natricine snake, *Virginia striatula* (Reptilia: Squamata).** *Journal of Morphology* 255(2): 177-201. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: reptiles, natricine snake, *Virginia striatula*, placenta, ultrastructure.

Stewart, J.R. and M.B. Thompson (2004). **Placental ontogeny of the Tasmanian scincid lizard, *Niveoscincus ocellatus* (Reptilia: Squamata).** *Journal of Morphology* 259(2): 214-237. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: lizards, *Niveoscincus ocellatus*, anatomy, histology, placenta anatomy, histology, placentation, placental ontogeny, pregnancy, uterus anatomy, histology.

Taylor, J.E. (2004). **Reproduction in sympatric lizards: comparison of two species of *Ctenotus* (Scincidae) in south-eastern Australia.** *Australian Journal of Zoology* 52(6): 649-666. ISSN: 0004-959X.
NAL Call Number: 410 Au73

Descriptors: reptiles, sympatric lizards, *Ctenotus robustus*, *Ctenotus taeniolatus*, reproduction, comparison of two species, Australia.

Thompson, M.B. and B.K. Speake (2002). **Energy and nutrient utilisation by embryonic reptiles.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 133(3): 529-538. ISSN: 1095-6433.

Abstract: Most reptiles are oviparous, with the developing embryos relying on the contents of the yolk to sustain development until hatching (lecithotrophy). The yolk is composed primarily of lipid and protein, which act as an energy source and the essential components to build embryonic tissue. Nevertheless, yolk and the resulting embryos contain many other nutrients, including inorganic ions, vitamins, carotenoids, water and hormones. Apart from water and oxygen, which may be taken up by eggs, and some inorganic ions that can come from the eggshell or even from outside the egg, everything required by the embryo must be in the egg when it is laid. Approximately 20% of squamate reptiles are viviparous, exhibiting a variety of placental complexities. Species with complex placentae have reduced yolk volumes, with the mother augmenting embryonic nutrition by provision across the placenta (placentotrophy). Despite assumed advantages of placentotrophy, only 5 out of approximately 100 lineages of viviparous squamates exhibit substantial placentotrophy. This paper reviews available and recent information on the yolk contents of a variety of squamate reptiles to ask the question, how are nutrients transported from the yolk to the embryo or across the placenta? Although, current available data suggest that, in broad terms, yolk is taken up by embryos without discrimination of the nutrients, there are some apparent exceptions, including the very long chain polyunsaturated fatty acids. In addition, fundamental differences in the patterns of energy utilisation in lizards and snakes suggest fundamental differences in lipid profiles in these taxa, which appear to reflect the differences between placentotrophic and lecithotrophic viviparous lizards.

Descriptors: reptiles, embryonic reptiles, energy, nutient, utilisation, yolk contents, placenta, nutrients, transport.

Thompson, M.B., S.M. Adams, J.F. Hebert, J.M. Biazik, and C.R. Murphy (2005). **Placental function in lizards.** In: *Animals and environments: Proceedings of the Third International Conference of Comparative Physiology and Biochemistry,August 7, 2004-August 13, 2004, KwaZulu-Natal, South Africa,* International Congress Series, 0531-5131, Elsevier: Amsterdam, p. 218-225. ISBN: 0444517634.

NAL Call Number: QP82 .I58 2004

Descriptors: reptiles, lizards, placental function, reproduction.

Thomson, M., J.F. Herbert, and M.B. Thompson (2006). **Tyrosine phosphorylated proteins in the reproductive tract of the viviparous lizard *Eulamprus tympanum* and the oviparous lizard *Lampropholis guichenoti.*** *Comparative Biochemistry and Physiology. Part B, Biochemistry and Molecular Biology* 144(3): 382-386. ISSN: 1096-4959.

Abstract: Plastic changes occur in the morphology of the uterus at various stages of the reproductive cycle in both oviparous and viviparous lizards and these may be influenced by estrogen. Estrogen driven phosphorylation of effector proteins on tyrosine residues plays

a major role in the plastic modulation of uterine anatomy and physiology in vertebrates. We used electrophoresis and Western blotting to characterize the phosphotyrosine protein profiles at various stages of the reproductive pathway in an oviparous lizard Lampropholis guichenoti and a viviparous lizard *Eulamprus tympanum. L. guichenoti* displayed major bands in the 200-35 kDa range and a triplet of bands of molecular masses 61 kDa, 52 kDa and 48 kDa in 50% of specimens and a 38 kDa band in all specimens. In contrast, *E. tympanum* samples all displayed a single major band at 40 kDa, which was significantly elevated at the early pregnancy stage. Somewhat paradoxically, the viviparous species, which has the more complex uterine epithelial changes during pregnancy, has the fewest phosphotyrosine bands, so how tyrosine phosphorylation is affected during the evolution of viviparity is not clear.
Descriptors: reptiles, viviparous lizard, *Eulamprus tympanum*, oviparous lizard, *Lampropholis guichenoti*, reproductive tract, tyrosine phosphorylated proteins, reproductive cycle.

Tourmente, M., G.A. Cardozo, H.A. Guidobaldi, L.C. Giojalas, M. Bertona, and M. Chiaraviglio (2007). **Sperm motility parameters to evaluate the seminal quality of *Boa constrictor occidentalis*, a threatened snake species.** *Research in Veterinary Science* 82(1): 93-98. ISSN: 0034-5288.
Abstract: Semen quality analysis constitutes a powerful tool to evaluate the fertility potential of males in threatened species. The Argentine boa constrictor or lampalagua (*Boa constrictor occidentalis*) is a threatened snake species and has been included in Appendix I of CITES. The objective of this work is to characterize the sperm of *B. c. occidentalis* on the bases of dynamic parameters to improve this species conservation. Dynamic parameters were measured in sperm samples using videomicroscopy and image analysis software. The sperm population showed a high degree of heterogeneity in velocity parameter values and 95% of the cells showed a linear pattern of movement. Studies in other species indicate that the number of motile spermatozoa and their movement speed is directly correlated with fertilization success. This work will help to establish basic parameter values for the evaluation of the reproductive potential of populations of *B. c. occidentalis* and to resolve questions referred to its reproductive strategies.
Descriptors: reptiles, snake, *Boa constictor occidentalis*, sperm motility parameters, seminal quality, motile spermatazoa.

Uribe Aranzabal, M.C., A. Hernandez Franyutti, and L.J.J. Guillette (2006). **Interembryonic regions of the uterus of the viviparous lizard *Mabuya brachypoda* (Squamata: Scincidae).** *Journal of Morphology* 267(4): 404-414. ISSN: 0362-2525.
Abstract: Analysis of the structure and physiology of the uterine incubation chambers of viviparous squamates has provided insight concerning adaptations for gestation. However, the literature addressing the biology of the interembryonic regions of the uterus is very limited, presumably because it has been assumed that this area has little role in the development and support of embryos in viviparous squamates. This study was undertaken to examine the histology of the interembryonic regions of *Mabuya brachypoda*, a viviparous lizard with microlecithal ova and consequently substantial matrotrophic activity. The incubation chambers are oval, distended zones of the uterus, adjacent to the interembryonic regions. The wall of the interembryonic regions includes: mucosa, formed by a cuboidal or columnar

epithelium with ciliated and nonciliated cells, and a lamina propria of vascularized connective tissue containing abundant acinar glands; myometrial smooth muscle consisting of inner circular and outer longitudinal layers; and serosa. The segment of the interembryonic region adjacent to the incubation chamber forms a transitional segment that displays folds of the mucosa that protrude into the uterine lumen. The limit of the incubation chamber is well defined by the long mucosal folds of the transitional segment. Long and thin extensions of extraembryonic membranes are present in the lumen of the transitional segment, outside of the incubation chamber region. The presence of abundant uterine glands and extraembryonic membranes in the interembryonic regions during gestation suggests uterine secretory activity and histotrophic transfer of nutrients to embryos in these regions.
Descriptors: lizards anatomy, histology, uterus anatomy, histology, viviparity, nonmammalian, embryo, lizards embryology, oviducts anatomy, histology.

Vercken, E., M. Massot, B. Sinervo, and J. Clobert (2007). **Colour variation and alternative reproductive strategies in females of the common lizard *Lacerta vivipara*.** *Journal of Evolutionary Biology* 20(1): 221-232. ISSN: 1010-061X.
Abstract: Within-sex colour variation is a widespread phenomenon in animals that often plays a role in social selection. In males, colour variation is typically associated with the existence of alternative reproductive strategies. Despite ecological conditions theoretically favourable to the emergence of such alternative strategies in females, the social significance of colour variation in females has less commonly been addressed, relative to the attention given to male strategies. In a population of the common lizard, females display three classes of ventral colouration: pale yellow, orange and mixed. These ventral colours are stable through individual's life and maternally heritable. Females of different ventral colourations displayed different responses of clutch size, clutch hatching success and clutch sex-ratio to several individual and environmental parameters. Such reaction patterns might reflect alternative reproductive strategies in females. Spatial heterogeneity and presence of density- and frequency-dependent feedbacks in the environment could allow for the emergence of such alternative strategies in this population and the maintenance of colour variation in females.
Descriptors: reptiles, common lizard, *Lacerta vivipara*, color variation, females, reproductive strategies.

Vieira, G.H., G.R. Colli, and S.N. Bao (2004). **The ultrastructure of the spermatozoon of the lizard *Iguana iguana* (Reptilia, Squamata, Iguanidae) and the variability of sperm morphology among iguanian lizards.** *Journal of Anatomy* 204(6): 451-464. ISSN: 0021-8782.
Abstract: The spermatozoon of *Iguana iguana* is filiform and resembles that of other iguanian lizards, being most similar to Tropidurus. All sperm synapomorphies of Tetrapoda, Amniota and Squamata are present in the sperm of *Iguana iguana*. By reconstructing the evolution of 30 sperm characters we identified a novel synapomorphy of Iguania: the presence of a well-developed acrosomal ridge at the level of the epinuclear lucent zone. Because of the poor topological resolution among iguanian clades we could not discount the possibility of convergence or neutral selection as determinant of the variability in characteristics of the sperm cell. In agreement with previous studies, we identified heterogeneous rates of evolution among the three main regions of the sperm cell, namely the head, midpiece and tail.

Descriptors: reptiles, lizard, *Iguana iguana*, spermatozoon, ultrastructure, sperm morphology, variability.

Villagran, M., F.R. Mendez, and J.R. Stewart (2005). **Placentation in the Mexican lizard *Sceloporus mucronatus* (Squamata: Phrynosomatidae).** *Journal of Morphology* 264(3): 286-297. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Abstract: We used light microscopy to study placental structure of the lizard *Sceloporus mucronatus* throughout 6 months of embryonic development. Three stages of placental development could be assigned to embryos based on the arrangement of the extraembryonic membranes. A highly vascular choriovitelline placenta was present in the embryonic hemisphere and a nonvascular bilaminar omphalopleure covered most of the abembryonic hemisphere of the egg during embryonic Stages 10-28. A chorioallantoic placenta replaced the choriovitelline placenta by embryonic Stage 29 and an omphaloplacenta covered the abembryonic hemisphere at this stage. The combination of these two placental types occurred in Stage 29-36 embryos. The final stage of placentation, embryonic Stages 37-40, was characterized by an omphalallantoic placenta in the abembryonic hemisphere and a chorioallantoic placenta in the embryonic hemisphere of the egg. The choriovitelline and chorioallantoic placentae are well vascularized, with closely apposed maternal and embryonic blood vessels. These structures are the most likely sites of respiratory exchange. In contrast, the omphaloplacenta and omphalallantoic placentae contain cuboidal or columnar epithelia and these structures may function in histotrophic exchange. Placentation of *S. mucronatus* is similar to that of predominantly lecithotrophic species in other squamate lineages suggesting that the evolution of this placental morphology is a response to similar factors and is independent of phylogeny.
Descriptors: lizards, *Sceloporus mucronatus*, anatomy, histology, growth, development, placenta anatomy, histology, placenta growth, development, embryo nonmammalian anatomy, histology, physiology, placenta physiology.

Visser, J. (2005). **Ervaringen met de kweek van *Iguana iguana*. [Some notes on breeding *Iguana iguana*.]**. *Lacerta* 63(5): 199-204. ISSN: 0023-7051.
Descriptors: reptiles, *Iguana iguana*, notes on breeding, diet, housing, temperature.
Language of Text: Dutch; Summary in English.

Vladimirova, I.G., T.A. Alekseeva, and M.V. Nechaeva (2005). **[Growth and oxygen consumption in embryonic and early postembryonic development of European pond turtle *Emys orbicularis* (Reptilia: Emydidae)]**. *Izvestiia Akademii Nauk. Seriia Biologicheskaia Rossiiskaia Akademiia Nauk*(2): 214-220. ISSN: 1026-3470.
Abstract: Experiments on developing eggs of European pond turtle (*Emys orbicularis*) demonstrated S-shaped changes in the rate of oxygen consumption and body weight during embryonic development. The rate of oxygen consumption and weight progressively increased within 70 days after hatching. During embryogenesis, the rate of oxygen consumption decreased. After hatching, it increased but then decreased to a certain level, which remained constant to the end of the studied period. We observed unidirectional changes in oxygen

consumption rate during embryonic period and this pattern was maintained after hatching as well. The coefficients of the allometric relationship between oxygen consumption and body weight were a = 0.33 and k = 0.52 during the embryonic period and a = 0.17 and k = 0.89 during the postembryonic period.
Descriptors: European pond turtle, *Emys orbicularis*, oxygen consumption, embryology, growth, development, metabolism, developing eggs, embryogenesis.
Language of Text: Russian.

Wallace, B.P., P.R. Sotherland, P. Santidrian Tomillo, R.D. Reina, J.R. Spotila, and F.V. Paladino (2007). **Maternal investment in reproduction and its consequences in leatherback turtles.** *Oecologia* 152(1): 37-47. ISSN: print: 0029-8549; online: 1432-1939.
NAL Call Number: QL750.O3
Abstract: Maternal investment in reproduction by oviparous non-avian reptiles is usually limited to pre-ovipositional allocations to the number and size of eggs and clutches, thus making these species good subjects for testing hypotheses of reproductive optimality models. Because leatherback turtles (*Dermochelys coriacea*) stand out among oviparous amniotes by having the highest clutch frequency and producing the largest mass of eggs per reproductive season, we quantified maternal investment of 146 female leatherbacks over four nesting seasons (2001-2004) and found high inter- and intra-female variation in several reproductive characteristics. Estimated clutch frequency [coefficient of variation (CV) = 31%] and clutch size (CV = 26%) varied more among females than did egg mass (CV = 9%) and hatchling mass (CV = 7%). Moreover, clutch size had an approximately threefold higher effect on clutch mass than did egg mass. These results generally support predictions of reproductive optimality models in which species that lay several, large clutches per reproductive season should exhibit low variation in egg size and instead maximize egg number (clutch frequency and/or size). The number of hatchlings emerging per nest was positively correlated with clutch size, but fraction of eggs in a clutch yielding hatchlings (emergence success) was not correlated with clutch size and varied highly among females. In addition, seasonal fecundity and seasonal hatchling production increased with the frequency and the size of clutches (in order of effect size). Our results demonstrate that female leatherbacks exhibit high phenotypic variation in reproductive traits, possibly in response to environmental variability and/or resulting from genotypic variability within the population. Furthermore, high seasonal and lifetime fecundity of leatherbacks probably reflect compensation for high and unpredictable mortality during early life history stages in this species.
Descriptors: reptiles, leatherback turtles, *Dermochelys coriacea*, maternal investment, reproduction, consquences.

Wang, R.P. and T.S. Xia (2005). **Reproduction of *Alligator sinensis* after artificial wintering.** *Chinese Journal of Zoology* 40(4): 92-95. ISSN: 0250-3263.
Descriptors: reptiles, reproduction, *Alligator sinensis*, artificial wintering, breeding success.
Language of Text: Chinese; English.

Wapstra, E., M. Olsson, R. Shine, A. Edwards, R. Swain, and J.M. Joss (2004). **Maternal basking behaviour determines offspring sex in a viviparous reptile.** *Proceedings of the Royal Society of London. Series B, Biological Sciences* 271(Suppl. 4): S230-S232. ISSN: 0080-4649.

Abstract: Two primary dichotomies within vertebrate life histories involve reproductive mode (oviparity versus viviparity) and sex determination (genotypic sex determination versus environmental sex determination). Although reptiles show multiple evolutionary transitions in both parameters, the co-occurrence of viviparity and environmental-dependent sex determination have heretofore been regarded as incompatible. Our studies on the viviparous lizard *Niveoscincus ocellatus* show that the extent of basking by a female influences the sex of her offspring. Critically, our data reveal this effect both in the field (via correlations between date of birth and litter sex ratio) and in a laboratory experiment (females with reduced basking opportunities produced more male offspring). Changes in thermoregulatory behaviour thus allow pregnant female lizards to modify the sex of their offspring.

Descriptors: reptiles, viviparous lizard, *Niveoscincus ocellatus*, maternal basking, offspring sex, sex determination, thermoregulatory behavior.

Warner, D.A., M.B. Lovern, and R. Shine (2007). **Maternal nutrition affects reproductive output and sex allocation in a lizard with environmental sex determination.** *Proceedings of the Royal Society of London. Series B, Biological Sciences* 274(1611): 883-890. ISSN: 0080-4649.

Abstract: Life-history traits such as offspring size, number and sex ratio are affected by maternal feeding rates in many kinds of animals, but the consequences of variation in maternal diet quality (rather than quantity) are poorly understood. We manipulated dietary quality of reproducing female lizards (*Amphibolurus muricatus*; Agamidae), a species with temperature-dependent sex determination, to examine strategies of reproductive allocation. Females maintained on a poor-quality diet produced fewer clutches but massively (twofold) larger eggs with lower concentrations of yolk testosterone than did conspecific females given a high-quality diet. Although all eggs were incubated at the same temperature, and yolk steroid hormone levels were not correlated with offspring sex, the nutrient-deprived females produced highly male-biased sex ratios among their offspring. These responses to maternal nutrition generate a link between sex and offspring size, in a direction likely to enhance maternal fitness if large body size enhances reproductive success more in sons than in daughters (as seems plausible, given the mating system of this species). Overall, our results show that sex determination in these animals is more complex, and responsive to a wider range of environmental cues, than that suggested by the classification of 'environmental sex determination'.

Descriptors: reptiles , female lizards, *Amphibolurus muricatus*, maternal nutrition, repoductive output, sex allocation, affects, sex determination.

Warner, D.A. and R. Shine (2005). **The adaptive significance of temperature-dependent sex determination: experimental tests with a short-lived lizard.** *Evolution International Journal of Organic Evolution* 59(10): 2209-2221. ISSN: print: 0014-3820; online: 1558-5646 .

NAL Call Number: 443.8 Ev62

Abstract: Why is the sex of many reptiles determined by the temperatures that these animals experience during embryogenesis, rather than by their genes? The Charnov-Bull model sug-

gests that temperature-dependent sex determination (TSD) can enhance maternal fitness relative to genotypic sex determination (GSD) if offspring traits affect fitness differently for sons versus daughters and nest temperatures either determine or predict those offspring traits. Although potential pathways for such effects have attracted much speculation, empirical tests largely have been precluded by logistical constraints (i.e., long life spans and late maturation of most TSD reptiles). We experimentally tested four differential fitness models within the Charnov-Bull framework, using a short-lived, early-maturing Australian lizard (*Amphibolurus muricatus*) with TSD. Eggs from wild-caught females were incubated at a range of thermal regimes, and the resultant hatchlings raised in large outdoor enclosures. We applied an aromatase inhibitor to half the eggs to override thermal effects on sex determination, thus decoupling sex and incubation temperature. Based on relationships between incubation temperatures, hatching dates, morphology, growth, and survival of hatchlings in their first season, we were able to reject three of the four differential fitness models. First, matching offspring sex to egg size was not plausible because the relationship between egg (offspring) size and fitness was similar in the two sexes. Second, sex differences in optimal incubation temperatures were not evident, because (1) although incubation temperature influenced offspring phenotypes and growth, it did so in similar ways in sons versus daughters, and (2) the relationship between phenotypic traits and fitness was similar in the two sexes, at least during preadult life. We were unable to reject a fourth model, in which TSD enhances offspring fitness by generating seasonal shifts in offspring sex ratio: that is, TSD allows overproduction of daughters (the sex likely to benefit most from early hatching) early in the nesting season. In keeping with this model, hatching early in the season massively enhanced body size at the beginning of the first winter, albeit with a significant decline in probability of survival. Thus, the timing of hatching is likely to influence reproductive success in this short-lived, early maturing species; and this effect may well differ between the sexes.

Descriptors: Australian lizard, *Amphibolurus muricatus*, physiological, embryology, sex ratio, temperature, embryo, physiology, embryonic development, growth, development, reproduction, sex determination, genetics.

Warner, D.A. and R. Shine (2007). **Reproducing lizards modify sex allocation in response to operational sex ratios.** *Biology Letters* 3(1): 47-50. ISSN: 1689-1392.

Abstract: Sex-allocation theory suggests that selection may favour maternal skewing of offspring sex ratios if the fitness return from producing a son differs from that for producing a daughter. The operational sex ratio (OSR) may provide information about this potential fitness differential. Previous studies have reached conflicting conclusions about whether or not OSR influences sex allocation in viviparous lizards. Our experimental trials with oviparous lizards (*Amphibolurus muricatus*) showed that OSR influenced offspring sex ratios, but in a direction opposite to that predicted by theory: females kept in male-biased enclosures overproduced sons rather than daughters (i.e. overproduced the more abundant sex). This response may enhance fitness if local OSRs predict survival probabilities of offspring of each sex, rather than the intensity of sexual competition.

Descriptors: reptiles, oviparous lizards, *Amphibolurus muricatus*, sex allocation, sex ratios, reproducing, maternal skewing.

Weiss, S.L., D.H. Jennings, and M.C. Moore (2002). **Effect of captivity in semi-natural enclosures on the reproductive endocrinology of female lizards.** *General and Comparative Endocrinology* 128(3): 238-246. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: reptiles, female lizards, reproductive endocrinology, effect of captivity, semi natural enclosures.

Weiss, S.L., G. Johnston, and M.C. Moore (2007). **Corticosterone stimulates hatching of late-term tree lizard embryos.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 146(3): 360-365. ISSN: 1095-6433.
Abstract: The regulation of hatching in oviparous animals is important for successful reproduction and survival, but is poorly understood. We unexpectedly found that RU-486, a progesterone and glucocorticoid antagonist, interferes with hatching of viable tree lizard (*Urosaurus ornatus*) embryos in a dose-dependent manner and hypothesized that embryonic glucocorticoids regulate hatching. To test this hypothesis, we treated eggs with corticosterone (CORT) or vehicle on Day 30 (85%) of incubation, left other eggs untreated, and observed relative hatch order and hatch time. In one study, the CORT egg hatched first in 9 of 11 clutches. In a second study, the CORT egg hatched first in 9 of 12 clutches, before vehicle-treated eggs in 10 of 12 clutches, and before untreated eggs in 7 of 9 clutches. On average, CORT eggs hatched 18.2 h before vehicle-treated eggs and 11.6 h before untreated eggs. Thus, CORT accelerates hatching of near-term embryos and RU-486 appears to block this effect. CORT may mobilize energy substrates that fuel hatching and/or accelerate lung development, and may provide a mechanism by which stressed embryos escape environmental stressors.
Descriptors: reptiles , tree lizard, *Urosaurus ornatus*, corticosterone stimulates hatching, late term embryos, regulation of hatching, progesterone, glucocorticoid.

Whitaker, N. (2006). **Immaculate conception, incubation protocols, and egg characteristics of the Ganges softshell turtle (*Aspideretes gangeticus*).** *Contemporary Herpetology* 2006(1): 1-6. ISSN: 1094-2246.
Descriptors: reptiles, softshell turtle, *Aspideretes gangeticus*, incubation protocols, egg characteristics, reproductive biology, research.

Wilkinson, L.R. and J. Whitfield Gibbons (2005). **Patterns of reproductive allocation: clutch and egg size variation in three freshwater turtles.** *Copeia* 2005(4): 868-879. ISSN: 0045-8511.
Descriptors: reptiles, freshwater turtles, reproductive allocation, patterns, clutch size, egg size, variation.

Willingham, E.J. (2005). **The effects of atrazine and temperature on turtle hatchling size and sex ratios.** *Frontiers in Ecology and the Environment* 3(6): 309-313. ISSN: 1540-9295.
NAL Call Number: QL540.F76
Descriptors: reptiles, atrazine, temperature, effects, turtle hatchling size, sex ratios, reproduction, tocixity.

Woodley, S.K. and M.C. Moore (2002). **Plasma corticosterone response to an acute stressor varies according to reproductive condition in female tree lizards (*Urosaurus ornatus*).** *General and Comparative Endocrinology* 128(2): 143-148. ISSN: 0016-6480.

NAL Call Number: 444.8 G28

Abstract: The magnitude of the glucocorticoid response to a stressor can depend on both environmental and physiological context. One factor that has not been examined is whether females of different reproductive states have different responses to a stressor. We examined whether corticosterone (CORT) increased after a 10 min handling stress in oviparous female tree lizards (*Urosaurus ornatus*) that were vitellogenic (yolking follicles) or gravid (post-ovulatory). We found that stressed vitellogenic females had a large increase in plasma CORT whereas gravid females did not. Baseline levels of CORT in gravid females were relatively high and similar to those in stressed vitellogenic females. The lack of a stress response in gravid females may be due to an inability to secrete higher levels of CORT or a suppression of the stress response. In addition, within vitellogenic females, CORT was positively correlated with ovarian weight, suggesting that CORT may function in some aspect of ovarian development during vitellogenesis.

Descriptors: reptiles, female tree lizards, *Urosaurus ornatus*, plasma corticosterone response, acute stressor, reproductive condition.

Woolley, S.C., J.T. Sakata, and D. Crews (2004). **Evolutionary insights into the regulation of courtship behavior in male amphibians and reptiles.** *Physiology and Behavior* 83(2): 347-360. ISSN: 0031-9384.

Abstract: Comparative studies of species differences and similarities in the regulation of courtship behavior afford an understanding of evolutionary pressures and constraints shaping reproductive processes and the relative contributions of hormonal, genetic, and ecological factors. Here, we review species differences and similarities in the control of courtship and copulatory behaviors in male amphibians and reptiles, focusing on the role of sex steroid hormones, the neurohormone arginine vasotocin (AVT), and catecholamines. We discuss species differences in the sensory modalities used during courtship and in the neural correlates of these differences, as well as the value of particular model systems for neural evolution studies with regard to reproductive processes. For example, in some genera of amphibians (e.g., Ambystoma) and reptiles (e.g., Cnemidophorus), interspecific hybridizations occur, making it possible to compare the ancestral with the descendant species, and these systems provide a window into the process of behavioral and neural evolution as well as the effect of genome size. Though our understanding of the hormonal and neural correlates of mating behavior in a variety of amphibian and reptilian species has advanced substantially, more studies that manipulate hormone or neurotransmitter systems are required to assess the functions of these systems.

Descriptors: amphibians, reptiles, courtship behavior, male, hormonal, genetic, species differences, copulatory behaviors.

Wright, K. (2005). **Reducing the incidence of reproductive problems in snakes and lizards.** *Exotic DVM* 7(3): 58-62. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, snakes, lizards, reproductive problems, reducing the incidence.

Xia, T.S. and X.Q. Jiang (2005). **Effect of environmental factors on nesting and laying eggs of Chinese alligator in captivity.** *Sichuan Journal of Zoology* 24(3): 373-377. ISSN: 1000-7083.
Descriptors: reptiles, Chinese alligator, *Alligator sinensis*, enviromental factors, effect, nesting, egg laying in captivity.
Language of Text: Chinese; Summary in Chinese and English.

Xia, T.S., K.H. Zhou, and J.L. Zhu (2006). **Influence of hibernant temperature on reproduction of Chinese alligator.** *Sichuan Journal of Zoology* 25(2): 398-399. ISSN: 1000-7083.
Descriptors: reptiles, Chinese alligator, hibernant temperature, reproduction, influence.
Language of Text: Chinese; Summary in Chinese and English.

Yajurvedi, H.N. and S. Menon (2005). **Influence of stress on gonadotrophin induced testicular recrudescence in the lizard *Mabuya Carinata*.** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 303(7): 534-540. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Abstract: Administration (ip) of FSH (10 IU/0.1 ml distilled water (dw)/lizard/alternate days/30 days) to adult male lizards, *Mabuya carinata*, during the early recrudescence phase of the reproductive cycle caused activation of spermatogenic and steroidogenic activity of the testis, as shown by a significant increase in mean number of spermatogonia, primary spermatocytes and spermatids, and serum levels of testosterone, as compared to initial controls. In addition, there were abundant spermatozoa in the lumen of the seminiferous tubules. Interestingly, administration of a similar dosage of FSH to lizards exposed to stressors (handling, chasing, and noise randomly applied, five times a day for 30 days) resulted in a significant increase in mean number of spermatogonia and primary spermatocytes over initial control values, whereas the number of secondary spermatocytes and spermatids and serum levels of testosterone did not significantly differ from those of initial controls, and were significantly lower than FSH treated normal lizards. Further, spermatozoa were infrequently found in the seminiferous tubules of these lizards. Treatment controls (receiving 0.1 ml dw/lizard/alternate days for 30 days) did not show significant variation in mean number of spermatogonia, spermatocytes and spermatids, and serum levels of testosterone from initial controls. Another group of lizards was exposed to stressors and did not receive FSH. These lizards showed a significant decrease in mean number of secondary spermatocytes compared to treatment controls and all other parameters did not significantly differ from those of both control groups. The results reveal that gonadotrophin-induced spermatogonial proliferation occurs under stressful conditions, whereas progress of spermatogenesis beyond primary spermatocyte stage is impaired due to inhibition (under stress) of gonadotrophin induced steroidogenic activity in *M. carinata*.

Descriptors: lizard, *Mabuya carinata*, stress, influence, gonadotrophin, induced testicular recrudescence, reproductive cycle, distilled water, testosterone, serum levels.

Zhang, F., X.b. Wu, W.z. Meng, and J.l. Zhu (2006). **Ecology on the making nest and laying eggs of Chinese alligator (*Alligator sinensis*) under artificial feeding conditions.** *Zoological Research* 27(2): 151-156. ISSN: 0254-5853.
NAL Call Number: QL1.T85
Descriptors: reptiles, Chinese alligator, *Alligatoe sinensis*, making nest, laying eggs, artificial feeding conditions, ecology, behavior.
Language of Text: Chinese; Summary in Chinese and English.

Zhang, X.D., X. Ji, L.G. Luo, J.F. Gao, and L. Zhang (2005). **Sexual dimorphism and female reproduction in the Qinghai toadheaded lizard *Phrynocephalus vlangalii*.** *Acta Zoologica Sinica* 51(6): 1006-1012. ISSN: 0001-7302.
Descriptors: reptiles, Qinghai toadheaded lizard, *Phrynocephalus vlangalii*, sexual dimorphism, female, reproduction.
Language of Text: Chinese; English.

Zhang, Y.p., X.p. Ying, and X. Ji (2005). **Ultrastructure of the spermatozoon of the northern grass lizard (*Takydromus septentrionalis*) with comments on the variability of sperm morphology among lizard taxa.** *Zoological Research* 26(5): 518-526. ISSN: 0254-5853.
Online: http://www.bioline.org.br/abstract?id=zr05047&lang=en
NAL Call Number: QL1.T85
Descriptors: reptiles, northern grass lizard, *Takydromus septentrionalis*, spermatozoon, ultrastructure, sperm mprphology, variability, comments.
Language of Text: Chinese; Summary in Chinese and English.

Zhu, X.P., Y.L. Chen, C.Q. Wei, Y.H. Liu, and J.F. Giu (2006). **Temperature effects on sex determination in yellow pond turtle (*Mauremys mutica* Cantor).** *Acta Ecologica Sinica* 26(2): 620-625. ISSN: 1000-0933.
Descriptors: reptiles, yellow pond turtle, *Mauremys mutica*, temperature effects, sex determination.
Language of Text: Chinese; Summary in Chinese and English.

Ziegler, T. and S. Olbort (2004). **Genitalstrukturen und Geschlechtsunterscheidung bei Krokodilen. [Genitalia structures and sex differentiation in crocodiles.]**. *Draco* 5(4): 39-47 Nr 20. ISSN: 1439-8168.
Descriptors: reptiles, crocodiles, sex differentiation, genitalia structures, genital differences.
Language of Text: German.

Research

Abu Reza, M.D. and R.M. Kini (2006). **Prothrombin activators from Australian snakes.** *Toxin Reviews* 25(3): 257-290. ISSN: 1556-9543.
NAL Call Number: RA1190.J669
Descriptors: reptiles, snakes, prothrombin activators, blood coagulation, snake venoms, Australia.

Afonso, C.L., E.R. Tulman, G. Delhon, Z. Lu, G.J. Viljoen, D.B. Wallace, G.F. Kutish, and D.L. Rock (2006). **Genome of crocodilepox virus.** *Journal of Virology* 80(10): 4978-4991. ISSN: 0022-538X.
NAL Call Number: QR360.J6
Abstract: Here, we present the genome sequence, with analysis, of a poxvirus infecting Nile crocodiles (*Crocodylus niloticus*) (crocodilepox virus; CRV). The genome is 190,054 bp (62% G+C) and predicted to contain 173 genes encoding proteins of 53 to 1,941 amino acids. The central genomic region contains genes conserved and generally colinear with those of other chordopoxviruses (ChPVs). CRV is distinct, as the terminal 33-kbp (left) and 13-kbp (right) genomic regions are largely CRV specific, containing 48 unique genes which lack similarity to other poxvirus genes. Notably, CRV also contains 14 unique genes which disrupt ChPV gene colinearity within the central genomic region, including 7 genes encoding GyrB-like ATPase domains similar to those in cellular type IIA DNA topoisomerases, suggestive of novel ATP-dependent functions. The presence of 10 CRV proteins with similarity to components of cellular multisubunit E3 ubiquitin-protein ligase complexes, including 9 proteins containing F-box motifs and F-box-associated regions and a homologue of cellular anaphase-promoting complex subunit 11 (Apc11), suggests that modification of host ubiquitination pathways may be significant for CRV-host cell interaction. CRV encodes a novel complement of proteins potentially involved in DNA replication, including a NAD(+)-dependent DNA ligase and a protein with similarity to both vaccinia virus F16L and prokaryotic serine site-specific resolvase-invertases. CRV lacks genes encoding proteins for nucleotide metabolism. CRV shares notable genomic similarities with molluscum contagiosum virus, including genes found only in these two viruses. Phylogenetic analysis indicates that CRV is quite distinct from other ChPVs, representing a new genus within the subfamily Chordopoxvirinae, and it lacks recognizable homologues of most ChPV genes involved in virulence and host range, including those involving interferon response, intracellular signaling, and host immune response modulation. These data reveal the unique nature of CRV and suggest mechanisms of virus-reptile host interaction.
Descriptors: alligators and crocodiles virology, Chordopoxvirinae genetics, genome, viral, multigene family, adenosine triphosphatases chemistry, adenosine triphosphatases genetics, amino acid sequence, chordopoxvirinae enzymology, DNA gyrase chemistry, DNA gyrase genetics, molecular sequence data, phylogeny, protein structure, tertiary, sequence alignment, sequence analysis, DNA, sequence homology, amino acid, ubiquitin protein ligases genetics.

Ahmad, M., R. Hasan, T. Naim, M. Ahmad, and T.B. Hanif (2003). **The effect of isoniazid (INH) on erythrocyte sedimentation rate in the lizard, *Uromastix hardwickii*.** *Journal of Applied Sciences* 38-39: 544-548. ISSN: 1607-8926.

Abstract: Erythrocyte sedimentation rate of isoniazid treated lizard was worked out. The gradual decrease for day 5 to day 10 and day 15 was found to be statistically significant. This is indicative of increase in erythrocyte membrane permeability with increase in the span of treatment. Newer cells are flooded in the blood stream due to loss of older cells. Newer cell resist sedimentation on day 10 and day 15.

Descriptors: reptiles, lizard, isoniazid, INH, effect , erythrocyte sedimentation rate, membrane permeability.

Al Dokhi, O.A. and S.H. Al Wasel (2002). **Ultrastructure of spermiogenesis in the freshwater turtle *Mauremys caspica* (Chelonia, Reptilia). III: The sperm tail formation.** *Journal of Union of Arab Biologists Cairo A Zoology* 18: 327-341. ISSN: 1110-5372.

Descriptors: reptiles, freshwater turtle, *Mauremys caspica* , spermiogenesis, sperm tail formation, ultrastructure, Arabia.

Language of Text: Arabic; English.

Alibardi, L. (2002). **Immunoreactivity of alpha- and beta-layers in lizard epidermis.** *Belgian Journal of Zoology* 132(1): 71-81. ISSN: 0777-6276.

NAL Call Number: QL1.B45

Abstract: Reptilian epidermis may share some mechanisms of keratinization with those of mammalian and avian epidermis. The expression of keratins and proteins associated with the process of keratinization (filaggrin) and formation of the cell corneus envelope (loricrin) has been analysed at the light microscopic and ultrastructural level in the complex normal and regenerating lizard epidermis. The localization of alpha and beta-keratins, and of filaggrin-like and loricrin-like immunoreactivities has confirmed that the epidermis of lizards consists of two different layers, an alpha-layer localizing alpha-keratins and showing weak filaggrin- and loricrin-like immunoreactivities, as in the mammalian epidermis, and a beta-layer that localizes a beta-keratin immunoreactivity, such as in scutate scales and feathers of birds. The present study suggests that the seg-regation of alpha- from beta-keratin synthesis is correlated with the evolution of an intraepidermal shedding layer that allows the epidermal molt.

Descriptors: reptiles, lizard, epidermis alpha layer, beta layer, immunoreactivity, keratinization, avian, proteins, molting.

Alibardi, L., L. Dalla Valle, V. Toffolo, and M. Toni (2006). **Scale keratin in lizard epidermis reveals amino acid regions homologous with avian and mammalian epidermal proteins.** *Anatomical Record. Part A, Discoveries in Molecular, Cellular, and Evolutionary Biology* 288(7): 734-752. ISSN: 1552-4884.

Abstract: Small proteins termed beta-keratins constitute the hard corneous material of reptilian scales. In order to study the cell site of synthesis of beta-keratin, an antiserum against a lizard beta-keratin of 15-16 kDa has been produced. The antiserum recognizes beta-cells of lizard epidermis and labels beta-keratin filaments using immunocytochemistry and immunoblotting. In situ hybridization using a cDNA-probe for a lizard beta-keratin mRNA labels

beta-cells of the regenerating and embryonic epidermis of lizard. The mRNA is localized free in the cytoplasm or is associated with keratin filaments of beta-cells. The immunolabeling and in situ labeling suggest that synthesis and accumulation of beta-keratin are closely associated. Nuclear localization of the cDNA probe suggests that the primary transcript is similar to the cytoplasmic mRNA coding for the protein. The latter comprises a glycine-proline-rich protein of 15.5 kDa that contains 163 amino acids, in which the central amino acid region is similar to that of chick claw/feather while the head and tail regions resemble glycine-tyrosine-rich proteins of mammalian hairs. This is also confirmed by phylogenetic analysis comparing reptilian glycine-rich proteins with cytokeratins, hair keratin-associated proteins, and claw/feather keratins. It is suggested that different small glycine-rich proteins evolved from progenitor proteins present in basic (reptilian) amniotes. The evolution of these proteins originated glycine-rich proteins in scales, claws, beak of reptiles and birds, and in feathers. Some evidence suggests that at least some proteins contained within beta-keratin filaments are rich in glycine and resemble some keratin-associated proteins present in mammalian corneous derivatives. It is suggested that glycine-rich proteins with the chemical composition, immunological characteristics, and molecular weight of beta-keratins may represent the reptilian counterpart of keratin-associated proteins present in hairs, nails, hooves, and horns of mammals. These small proteins produce a hard type of corneous material due to their dense packing among cytokeratin filaments.

Descriptors: avian proteins, lizard epidermis, epidermis embryology, keratins, lizards embryology, amino acid, avian proteins, ultrastructure, epidermis ultrastructure, immunohistochemistry, keratins genetics, lizards anatomy, histology, metabolism.

Alibardi, L., E. Spisni, A.G. Frassanito, and M. Toni (2004). **Characterization of beta-keratins and associated proteins in adult and regenerating epidermis of lizards.** *Tissue and Cell* 36(5): 333-349. ISSN: 0040-8166.

NAL Call Number: QH573.T5

Abstract: Reptilian epidermis contains two types of keratin, soft (alpha) and hard (beta). The biosynthesis and molecular weight of beta-keratin during differentiation of lizard epidermis have been studied by autoradiography, immunocytochemistry and immunoblotting. Tritiated proline is mainly incorporated into differentiating and maturing beta-keratin cells with a pattern similar to that observed after immunostaining with a chicken beta-keratin antibody. While the antibody labels a mature form of beta-keratin incorporated in large filaments, the autoradiographic analysis shows that beta-keratin is produced within the first 30 min in ribosomes, and is later packed into large filaments. Also the dermis incorporates high amount of proline for the synthesis of collagen. The skin was separated into epidermis and dermis, which were analyzed separately by protein extraction and electrophoresis. In the epidermal extract proline-labeled proteic bands at 10, 15, 18-20, 42-45, 52-56, 85-90 and 120 kDa appear at 1, 3 and 5 h post-injection. The comparison with the dermal extract shows only the 85-90 and 120 kDa bands, which correspond to collagen. Probably the glycine-rich sequences of collagen present also in beta-keratins are weakly recognized by the beta-1 antibody. Immunoblotting with the beta-keratin antibody identifies proteic bands according to the isolation method. After-saline or urea-thiol extraction bands at 10-15, 18-20, 40, 55 and 62 kDa appear. After extraction and carboxymethylation, weak bands at 10-15, 18-20

and 30-32 kDa are present in some preparations, while in others also bands at 55 and 62 kDa are present. It appears that the lowermost bands at 10-20 kDa are simple beta-keratins, while those at 42-56 kDa are complex or polymeric forms of beta-keratins. The smallest beta-keratins (10-20 kDa) may be early synthesized proteins that are polymerized into larger beta-keratins which are then packed to form larger filaments. Some proline-labeled bands differ from those produced after injection of tritiated histidine. The latter treatment does not show 10-20 kDa labeled proteins, but tends to show bands at 27, 30-33, 40-42 and 50-62 kDa. Histidine-labeled proteins mainly localize in keratohyalin-like granules and dark keratin bundles of clear-oberhautchen layers of lizard epidermis, and their composition is probably different from that of beta-keratin.

Descriptors: reptiles, lizards, beta keratins, epidermis, associated proteins, regenerating epidermis, adult, soft keratin, hard keratin, characterization.

Alibardi, L. and M. Toni (2006). **Skin structure and cornification proteins in the soft-shelled turtle *Trionyx spiniferus*.** *Zoology [Jena]* 109(3): 182-195. ISSN: 0944-2006.

NAL Call Number: QL1.Z769

Abstract: In contrast to most chelonians, the fully aquatic soft-shelled turtles have a smooth, unscaled, and pliable shell. The skin of the shell, tail, limbs, and neck of juveniles of *Trionyx spiniferus* has been studied by ultrastructural, immunocytochemical, and immunoblotting methods. The epidermis of the carapace and plastron has a thick corneous layer composed of alpha-corneocytes surrounded by a cornified cell envelope. The softer epidermis is similar to that of the shell but the epidermis and corneous layer are much thinner. Pre-corneous cells in both soft and shell epidermis are rich in vesicles produced in the Golgi apparatus and smooth endoplasmic vesicles, and contain numerous dense-core mucus-like and vesicular (lamellar) bodies. Secreted material is present among corneocytes where it probably forms an extensive intercellular lipid-mucus waterproof barrier. The dermis is very thick and composed of several layers of collagen bundles that form a plywood-patterned dermis. This dermis constitutes a strong mechanical barrier that compensates for the low content in beta-keratin, and lack of cornified scutes and dermal bones. The growth of the shell mainly occurs along the lateral margins. Immunocytochemistry reveals the presence of some beta-keratin in soft and shell epidermis, and this is confirmed by immunoblotting where bands at 18 and 32-35 kDa are present. Other proteins of the cornified cell envelope (loricrin and sciellin) or associated to lipid trafficking (caveolin-1) are also detected by immunoblotting. Loricrin positive bands at 24 and 57 kDa are present while bands cross-reactive for sciellin are seen at 45 and 53 kDa. Caveolin-1 positive bands are seen at 21-22 kDa. The presence of these proteins indicates that the epidermis is both coriaceous and waterproof. These results suggest that the shell of Trionyx is tough enough to be as mechanically efficient as the hard shell of the other turtles. At the same time, a soft shell is lighter, its shape is more easily controlled by muscles, and it allows a more controlled closure and retraction of limbs and neck inside the shell. Thus, the shell makes the animal more streamlined for swimming.

Descriptors: reptiles, swimming, soft shelled turtles, *Trionyx spiniferus*, skin structure, chelonians, aquatic, cornification proteins, pliable shell, ultrastructural.

Alibardi, L. (2003). **Adaptation to the land: The skin of reptiles in comparison to that of amphibians and endotherm amniotes.** *Journal of Experimental Zoology* 298B(1): 12-41. ISSN: 0022-104X.
NAL Call Number: 410 J825
Descriptors: reptiles, amphibian, skin, comparison, endoderm, amniotes, skin comparison, adaptation.

Alibardi, L. and M. Toni (2007). **Immunological characterization of a newly developed antibody for localization of a beta-keratin in turtle epidermis**. *Journal of Experimental Zoology Part B. Molecular and Developmental Evolution* 308B(2): 200-208. ISSN: print: 1552-5007; online: 1552-5015.
NAL Call Number: QL1.J87
Descriptors: reptiles, turtle epidermis, turtle scutes, beta keratin, newly developed antibody, immunological characterization.

Alves de Matos, A.P., I. Paperna, and E. Crespo (2002). **Experimental infection of lacertids with lizard erythrocytic viruses.** *Intervirology* 45(3): 150-159. ISSN: 0300-5562.
NAL Call Number: QR355.I5
Descriptors: reptiles, lizard, experimental infection, erythrocytic viruses, lacertids.

Aranyosi, A.J. and D.M. Freeman (2005). **Two modes of motion of the alligator lizard cochlea: measurements and model predictions.** *Journal of the Acoustical Society of America.* 118(3 Pt 1): 1585-1592. ISSN: 0001-4966.
Abstract: Measurements of motion of an in vitro preparation of the alligator lizard basilar papilla in response to sound demonstrate elliptical trajectories. These trajectories are consistent with the presence of both a translational and rotational mode of motion. The translational mode is independent of frequency, and the rotational mode has a displacement peak near 5 kHz. These measurements can be explained by a simple mechanical system in which the basilar papilla is supported asymmetrically on the basilar membrane. In a quantitative model, the translational admittance is compliant while the rotational admittance is second order. Best-fit model parameters are consistent with estimates based on anatomy and predict that fluid flow across hair bundles is a primary source of viscous damping. The model predicts that the rotational mode contributes to the high-frequency slopes of auditory nerve fiber tuning curves, providing a physical explanation for a low-pass filter required in models of this cochlea. The combination of modes makes the sensitivity of hair bundles more uniform with radial position than that which would result from pure rotation. A mechanical analogy with the organ of Corti suggests that these two modes of motion may also be present in the mammalian cochlea.
Descriptors: alligator lizard, basilar membrane physiology, cochlea physiology, lizard physiology, movement physiology, basilar membrane anatomy, histology, hair cells physiology, models.

Ariel, M. (2005). **Latencies of climbing fiber inputs to turtle cerebellar cortex.** *Journal of Neurophysiology* 93(2): 1042-1054. ISSN: 0022-3077.

Abstract: Responses of separate regions of rat cerebellar cortex (Cb) to inferior olive (IO) stimulation occur with the same latency despite large differences in climbing fiber (CF) lengths. Here, the olivocerebellar path of turtle was studied because its Cb is an unfoliated sheet on which measurements of latency and CF length can be made directly across its entire surface in vitro. During extracellular DC recordings at a given Cb position below the molecular layer, IO stimulation evoked a large negative field potential with a half-width duration of approximately 6.5 ms. On this response were smaller oscillations similar to complex spikes. The stimulating electrode was moved to map the IO and the CF path from the brain stem to the Cb. The contralateral brain stem region that evoked these responses was tightly circumscribed within the medulla, lateral and deep to the obex. This response remained when the brain stem was bathed in solutions that blocked synaptic transmission. The Cb response to IO stimulation had a peak latency of approximately 10 ms that was not dependent on the position of the recording electrode across the entire 8-mm rostrocaudal length of the Cb. However, for a constant Cb recording position, moving the stimulation across the midline to the ipsilateral brain stem and along the lateral wall of the fourth ventricle toward the peduncle did shorten the response latency. Therefore a synchronous Cb response to CF stimulation seems to be caused by changes in its conduction velocity within the entire cerebellar cortex but not within the brain stem.

Descriptors: turtle, cerebellar cortex physiology, nerve fibers physiology, reaction time physiology, turtles physiology, action potentials physiology, afferent pathways physiology, brain stem physiology.

Avall Severinsen, S., J. Morup Jorgensen, and J. Randel Nyengaard (2003). **Structure and growth of the utricular macula in the inner ear of the slider turtle *Trachemys scripta.*** *Journal of the Association for Research in Otolaryngology* 4(4): 505-520. ISSN: print: 1525-3961; online: 1438-7573.

Abstract: In general, postembryonic production of inner ear vestibular hair cells (HCs) is believed to occur in all nonmammalian vertebrates. However, no study on this topic has been published on reptiles and, consequently, it is not known whether this also applies to these vertebrates. Therefore, the present study applied stereological methods in order to estimate the total number of HCs in turtles of varying sizes. The findings are that in prehatchlings the utricular macula (UM) contains approximately 4000 HCs as compared to approximately 5000 in juveniles, approximately 8000 in medium-sized turtles, and approximately 12,000 in large, sexually mature turtles. Scanning electron microscopy (SEM) reveals that presumably newly generated HCs with small surface areas and thin stereovilli are found in all regions of the UM. Furthermore, it reveals that utricular HCs can be classified as belonging to a specific region from the morphology of their apical structure. Striolar HCs have a large free oval-to-ovoid surface, a hair bundle with numerous stereovilli, and a short kinocilium. Rampary and cotillary HCs have smaller and slimmer free surfaces, comparatively fewer stereovilli, but much longer kinocilia. In conclusion, the current study demonstrates that postembryonic production of HCs does occur in reptiles and thereby supports the general view that this is a

common trait in all nonmammalian vertebrates.
Descriptors: reptiles, slider turtle, inner ear, utricular macula, structure, growth.

Avallone, B., M. Porritiello, D. Esposito, R. Mutone, G. Balsamo, and F. Marmo (2003). **Evidence for hair cell regeneration in the crista ampullaris of the lizard *Podarcis sicula*.** *Hearing Research* 178(1-2): 79-88. ISSN: 0378-5955.
Abstract: We studied hair cell regeneration in the crista ampullaris of the lizard *Podarcis sicula* both in untreated animals and at early and late time intervals following a single high dose of gentamicin. The study was carried out using the S-phase marker 5-bromo-2'-deoxyuridine. Our ultrastructural and immunofluorescence studies showed that both apoptosis and hair cell regeneration happen in the lizard crista ampullaris in untreated animals, and that regenerative processes are greatly accelerated after treatment with the aminoglycoside antibiotic gentamicin. Our observations indicate that hair cell regeneration is strongly implicated in the repair of damaged sensory epithelium, and that new hair cells appear likely to arise from supporting cells.
Descriptors: reptiles, lizard, hair cell regeneration, crista ampullaris , gentamicin, apoptosis, repair, damaged sensory epithelium.

Barbour, H.R., M.A. Archer, N.S. Hart, N. Thomas, S.A. Dunlop, L.D. Beazley, and J. Shand (2002). **Retinal characteristics of the ornate dragon lizard, *Ctenophorus ornatus*.** *Journal of Comparative Neurology.* 450(4): 334-344. ISSN: 0021-9967.
Descriptors: reptiles, lizard, iguanas, retinal characteristics, anatomy, histology, epithelium of eye, retina physiology, retina ultrastructure, cones.

Bartell, P.A., M. Miranda Anaya, and M. Menaker (2004). **Period and phase control in a multioscillatory circadian system (*Iguana iguana*).** *Journal of Biological Rhythms* 19(1): 47-57. ISSN: Print: 0748-7304; online: 1552-4531.
NAL Call Number: QH527.J68
Abstract: The circadian system of the lizard *Iguana iguana* is composed of several independent pacemakers that work in concert: the pineal gland, retinae of the lateral eyes, and a fourth oscillator presumed to be located in the hypothalamus. These pacemakers govern the circadian expression of multiple behaviors and physiological processes, including rhythms in locomotor activity, endogenous body temperature, electroretinogram, and melatonin synthesis. The numerous, easily measurable rhythmic outputs make the iguana an ideal organism for examining the contributions of individual oscillators and their interactions in governing the expression of overt circadian rhythms. The authors have examined the effects of pinealectomy and enucleation on the endogenous body temperature rhythm (BTR) and locomotor activity rhythm (LAR) of juvenile iguanas at constant temperature both in LD cycles and in constant darkness (DD). They measured the periods (tau) of the circadian rhythms of LAR and BTR, the phase relationships between them in DD (psiAT), and the phase relationship between each rhythm and the light cycle (psiRL). Pinealectomy lengthened tau of locomotor activity in all animals tested and abolished the BTR in two-thirds of the animals. In those animals in which the BTR did persist following pinealectomy, tau lengthened to the same extent as that of locomotor activity. Pinealectomy also delayed the onset of activity with

respect to its normal phase relationship with body temperature in DD. Enucleation alone had no significant effect on tau of LAR or BTR; however, after enucleation, BTR became 180 degrees out of phase from LAR in DD. After both pinealectomy and enucleation, 4 of 16 animals became arrhythmic in both activity and body temperature. Their data suggest that rhythmicity, period, and phase of overt circadian behaviors are regulated through the combined output of multiple endogenous circadian oscillators.
Descriptors: reptiles , lizard, *Iguana iguana*, multioscullatory circadian system, periodic, phase control, pacemakers.

Belliure, J. and J. Clobert (2004). **Behavioral sensitivity to corticosterone in juveniles of the wall lizard, *Podarcis muralis*.** *Physiology and Behavior* 81(1): 121-127. ISSN: 0031-9384.
Abstract: Reptiles exposed to stressful conditions respond with increases in plasma levels of corticosterone (CORT). The outcome of such hormonal fluctuations can affect the organism's physiology and behavior; however, relatively few studies in reptiles have progressed past the effects of stress on the plasma levels of CORT. The purpose of this study was to investigate the effects of CORT on lizard behavior. We focused on activity and thermoregulation of juveniles of the wall lizard, *Podarcis muralis*. Juveniles with experimentally elevated plasma CORT concentrations showed a higher moving rate and spent a greater amount of time moving. They also spent more time being involved in attempts to escape from a terrarium. This enhanced locomotor activity was associated with significant changes in thermoregulatory behavior, as CORT-increased individuals had reduced thermoregulatory activity than the controls. The same pattern of results was obtained in nature and under laboratory conditions. Thus, CORT levels appear to mediate an important trade-off between locomotor activity and thermoregulation. To our knowledge, this is the first time that the effect of CORT on lizard thermoregulation has been examined.
Descriptors: reptiles, wall lizard, *Podarcis muralis*, juveniles, corticosterone, behavioral sensitivity, stressful conditions, plasma levels.

Bennis, M., J. Reperant, R. Ward, J.P. Rio, S.B.A. M'hamed, and B. Jay (2006). **The postnatal development of the optic nerve of a reptile (*Vipera aspis*): a quantitative ultrastructural study**. *Anatomy and Embryology* 211(6): 691-705. ISSN: 0340-2061.
Descriptors: reptiles, *Vipera aspis*, birds, mammals, optic nerve, postnatal development, axons, ultrastructural study, electron micrographs.

Benson, K.G., L.A. Tell, L.A. Young, S. Wetzlich, and A.L. Craigmill (2003). **Pharmacokinetics of ceftiofur sodium after intramuscular or subcutaneous administration in green iguanas (*Iguana iguana*).** *American Journal of Veterinary Research* 64(10): 1278-1282. ISSN: 0002-9645.
NAL Call Number: 41.8 Am3A
Abstract: OBJECTIVE: To determine the pharmacokinetics of ceftiofur sodium after IM and SC administration in green iguanas. ANIMALS: 6 male and 4 female adult green iguanas. PROCEDURE: In a crossover design, 5 iguanas received a single dose of ceftiofur sodium (5 mg/kg) IM, and 5 iguanas received the same dose SC. Blood samples were taken at 0, 20, and 40 minutes and 1, 2, 4, 8, 24, 48, and 72 hours after administration. After a

10-week washout period, each iguana was given the same dose via the reciprocal administration route, and blood was collected in the same fashion. Ceftiofur free-acid equivalents were measured via high-performance liquid chromatography. RESULTS: The first phase intercepts were significantly different between the 2 administration routes. Mean maximum plasma concentration was significantly higher with the IM (28.6 +/- 8.0 microg/mL) than the SC (18.6 +/- 8.3 microg/mL) administration route. There were no significant differences between terminal half-lives (harmonic mean via IM route, 15.7 +/- 4.7 hours; harmonic mean via SC route, 19.7 +/- 6.7 hours) and mean areas under the curve measured to the last time point (IM route, 11,722 +/- 7,907 microg x h/mL; SC route, 12,143 +/- 9,633 microg x h/mL). Ceftiofur free-acid equivalent concentrations were maintained > or = 2 microg/mL for > 24 hours via both routes. CONCLUSIONS AND CLINICAL RELEVANCE: A suggested dosing schedule for ceftiofur sodium in green iguanas for microbes susceptible at > 2 microg/mL would be 5 mg/kg, IM or SC, every 24 hours.
Descriptors: reptiles, green iguanas, ceftiofur sodium, pharmacokinetics, administration, intramuscular, subcutaneous, blood samples, dosing schedule.

Bertolotto, C.E.V., K.C.M. Pellegrino, and Y. Yonenaga Yassuda (2004). **Occurrence of B chromosomes in lizards: a review.** *Cytogenetic and Genome Research* 106(2-4): 243-246. ISSN: 1424-8581.
NAL Call Number: QH431.C95
Descriptors: reptiles, B chromosomes, lizards, occurrence, review.

Bouma, M.J., C.J. Smallridge, C.M. Bull, and J. Komdeur (2007). **Susceptibility to infection by a haemogregarine parasite and the impact of infection in the Australian sleepy lizard *Tiliqua rugosa*.** *Parasitology Research* 100(5): 949-954. ISSN: 0932-0113.
Abstract: The Hamilton and Zuk hypothesis on haemoparasite-mediated sexual selection and certain studies of fitness are based on the assumption that blood parasite infections are detrimental to their hosts. However, there are few reports that have demonstrated harmful effects of endemic blood parasites on fitness in wild populations, and it has even been suggested that they may be non-pathogenic. In this paper, we show that individuals of the Australian sleepy lizard (*Tiliqua rugosa*) have smaller home ranges when they are infected with the haemogregarine blood parasite *Hemolivia mariae* than when no infection can be detected. An apparently contradictory result was that lizards with larger home ranges were more susceptible to infection under experimental exposure to Hemolivia. We propose that lizards sacrifice defence against pathogens by increased activity, perhaps associated with maintaining home ranges and mating opportunities. As a consequence, they gain higher parasite loads, which in turn inhibit their activity. In this case, the parasite-host interaction may act as a buffer of lizard activity.
Descriptors: reptiles, sleepy lizard, *Tiliqua rugosa*, blood parasites, infection, home ranges, hemogregarine parasite, susceptibility.

Brown, J.D., J.M. Richards, J. Robertson, S. Holladay, and J.M. Sleeman (2004). **Pathology of aural abscesses in free-living Eastern box turtles (*Terrapene carolina carolina*).** *Journal of Wildlife Diseases* 40(4): 704-712. ISSN: 0090-3558.

NAL Call Number: 41.9 W64B
Abstract: Aural abscess or abscess of the middle ear is common in free-living Eastern box turtles (*Terrapene carolina carolina*) of Virginia (USA) and elsewhere. Although its etiology remains unknown, hypovitaminosis A has been suggested on the basis of similar lesions occurring in captive chelonians fed diets that are deficient in vitamin A. This hypothesis was supported by significantly greater body burdens of organochlorine compounds (reported disruptors of vitamin A metabolism) and a nonsignificant trend toward lower serum and hepatic vitamin A levels in free-living box turtles with this lesion. The tympanic epithelium was evaluated in 27 box turtles (10 with aural abscesses and 17 without). Lesions of the tympanic epithelium of box turtles with aural abscesses included hyperplasia, squamous metaplasia, hyperemia, cellular sloughing, granulomatous inflammation, and bacterial infection. These changes were more severe in turtles with aural abscesses than in those without and were more severe in tympanic cavities that had an abscess compared to those without when the lesion was unilateral. Organs from 21 box turtles (10 with aural abscesses and 11 without) from the study population were examined for microscopic lesions, and minimal histopathologic changes were found, none of which were similar to those found in the tympanic epithelium. Histopathologic changes in box turtles with aural abscesses were consistent with a syndrome that may involve hypovitaminosis A.
Descriptors: reptiles, Eastern box turtle, free living, aural abscesses, middle ear, hypovitaminosis A, deficient diet, chelonians, histopathologic changes.

Bulte, G., C. Verly, and G. Blouin Demers (2006). **An improved blood sampling technique for hatchling emydid turtles**. *Herpetological Review* 37(3): 318-319. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, emydid turtles, hatchling, improved blood sampling technique.

Burghardt, G.M. (2004). **Iguana research: looking back and looking ahead.** In: A.C. Alberts, R.L. Carter, W.K. Hayes and E.P. Martins (Editors), *Iguanas: Biology and Conservation.,* University of California Press: Berkeley, Los Angeles and London., p. 1-12. ISBN: 0520238540.
Descriptors: reptiles, iguanas, biology, conservation, research, book chapter.

Calderon, M.L., G.R. de Perez, and M.P. Ramirez Pinilla (2004). **Morphology of the ovary of *Caiman crocodilus* (Crocodylia: Alligatoridae).** *Annals of Anatomy* 186(1): 13-24. ISSN: 0940-9602.
Descriptors: reptiles, *Caiman crocodilus*, ovary, morphology, reproduction.

Carroll, R. (2006). **Marine adaptation in reptiles: a model for the study of large scale patterns and processes of evolution**. *Journal of Vertebrate Paleontology* 26(3, Suppl. S): 48A. ISSN: 0272-4634.
Descriptors: reptiles, marine adaptation, processes of evolution, study, model, patterns, meeting abstract.
Notes: Meeting Information: 66th Annual Meeting of the Society of Vertebrate Paleontology, Ottawa, Canada; October 18 -21, 2006.

Castro, H.C. and C. Rangel Rodrigues (2006). **Current status of snake venom thrombin-like enzymes.** *Toxin Reviews* 25(3): 291-318. ISSN: 1556-9543.
NAL Call Number: RA1190.J669
Descriptors: reptiles, snake venom, thrombin-like enzymes, current status, therapeutic use.

Chattopadhyay, S., N.K. Sinha, S. Banerjee, D. Roy, D. Chattopadhyay, and S. Roy (2006). **Small cationic protein from a marine turtle has beta-defensin-like fold and antibacterial and antiviral activity.** *Proteins* 64(2): 524-531. ISSN: 0887-3585.
Descriptors: reptiles, marine turtle, small cationic protein, beta-defensin like fold, antibacterial, antiviral, activity.

Chen, Q.S., Z.H. Su, and X.W. Chen (2005). **Morphological studies on cells involved in mucosal immunity of the intestine in the Chinese soft-shelled turtle.** *Acta Hydrobiologica Sinica* 29(6): 654-660. ISSN: 1000-3207.
NAL Call Number: QH540
Descriptors: reptiles, Chinese soft shelled turtle, *Trionyx sinensis*, intestine, mucosal immunity, cells, morphological studies.
Language of Text: Chinese; Summary in Chinese and English.

Chien, J.T., I. Chowdhury, Y.S. Lin, C.F. Liao, S.T. Shen, and J.Y. Yu (2006). **Molecular cloning and sequence analysis of a cDNA encoding pituitary thyroid stimulating hormone beta-subunit of the Chinese soft-shell turtle *Pelodiscus sinensis* and regulation of its gene expression.** *General and Comparative Endocrinology* 146(2): 74-82. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: A cDNA encoding thyroid stimulating hormone beta-subunit (TSHbeta) was cloned from pituitary of the Chinese soft-shell turtle, *Pelodiscus sinensis*, and its regulation of mRNA expression was investigated for the first time in reptile. The Chinese soft-shell turtle TSHbeta cDNA was cloned from pituitary RNA by reverse transcription and polymerase chain reaction (RT-PCR), and rapid amplification cDNA end (RACE) methods. The Chinese soft-shell turtle TSHbeta cDNA consists of 580-bp nucleotides, including 67-bp nucleotides of 5'-untranslated region (UTR), 402-bp of the open reading frame, and 97-bp of 3'-UTR followed by a 14 poly (A) trait. It encodes a precursor protein molecule of 133 amino acids with a putative signal peptide of 19 amino acids and a putative mature protein of 114 amino acids. The number and position of 12 cysteine residues, presumably forming six disulfide bonds, one putative asparagine-linked glycosylation site, and six proline residues that are found at positions for changing the backbone direction of the protein have been conserved in the turtle as in other vertebrate groups. The deduced amino acid sequence of the Chinese soft-shell turtle TSHbeta mature protein shares identities of 82-83% with birds, 71-72% with mammals, 49-57% with amphibians, and 44-61% with fish. The Chinese soft-shell turtle pituitaries were incubated in vitro with synthetic TRH (TSH-releasing hormone), thyroxine and triiodothyronine at doses of 10(-10) and 10(-8)M. TRH stimulated, while thyroid hormones suppressed, TSHbeta mRNA levels in dose-related manner. The sequences of cDNA and its deduced peptide of TSHbeta as well as the regulation of its mRNA level were reported for the first time in reptile.

Descriptors: Chinese soft-shell turtle, *Pelodiscus sinensis*, thyrotropin, beta subunit biosynthesis, genetics, turtles genetics, physiology, amino acid sequence, base sequence, cloning, molecular, DNA, complementary analysis, gene expression regulation, molecular sequence data, nucleic acid amplification techniques, RNA, messenger biosynthesis, reverse transcriptase polymerase chain reaction, sequence analysis, DNA.

Christensen Dalsgaard, J. and G.A. Manley (2005). **Directionality of the lizard ear.** *Journal of Experimental Biology.* 208(Pt 6): 1209-1217. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01511
NAL Call Number: 442.8 B77
Abstract: Lizards have highly sensitive ears, but most lizard heads are small (1-2 cm in diameter) compared to the wavelengths of sound of frequencies to which they are most sensitive (1-4 kHz, wavelengths 34-8.5 cm). Therefore, the main cues to sound direction that mammals use - binaural time and intensity cues due to arrival-time differences and sound shadowing by the head--will be very small in lizards. The present work shows that acoustical coupling of the two eardrums in lizards produces the largest directionality of any terrestrial vertebrate ear studied. Laser vibrometric studies of tympanic motion show pronounced directionality within a 1.8-2.4 kHz frequency band around the best frequency of hearing, caused by the interference of ipsi- and contralateral inputs. The results correspond qualitatively to the response of a simple middle ear model, assuming coupling of the tympana through a central cavity. Furthermore, observed directional responses are markedly asymmetrical, with a steep gradient of up to 50-fold (34 dB) response differences between ipsi- and contralateral frontal angles. Therefore, the directionality is easily exploitable by simple binaural subtraction in the brain. Lizard ears are the clearest vertebrate examples of directionality generated by tympanic coupling.
Descriptors: lizard, auditory perception, hearing physiology, sound localization, acoustic stimulation, tympanic membrane.

Christian, K.A., C.R. Tracy, and C.R. Tracy (2006). **Evaluating thermoregulation in reptiles: An appropriate null model**. *American Naturalist* 168(3): 421-430. ISSN: 0003-0147.
NAL Call Number: 470 Am36
Descriptors: reptiles, thermoregulation, evaluating, null model, ectotherms, thermal inertia, body mass, warming, cooling.

Clusella Trullas, S., J.S. Terblanche, J.H. van Wyk, and J.R. Spotila (2007). **Low repeatability of preferred body temperature in four species of Cordylid lizards: Temporal variation and implications for adaptive significance.** *Evolutionary Ecology* 21(1): 63-79. ISSN: 0269-7653.
Abstract: Preferred body temperatures (T sel) of ectotherms are important for ecological and evolutionary studies. In lizards, the measurement of T sel is controversial for several reasons, generally related to hypotheses addressing how T sel may evolve in the wild. Although seldom explicitly tested, evolutionary hypotheses of adaptation to local climate require that T sel meets the conditions of natural selection, which include repeatability, heritability and a link to fitness. Here, we investigated repeatability ((Sx(B, intra-class correlation coeffi-

cient) of T sel at several time-scales using four Cordylid species from heterogeneous thermal habitats. Although there was significant inter-individual variation within days (P < 0.005 in most cases), there was no significant inter-individual variation when calculated across several days (P > 0.05). Repeatability was low in all species investigated (from 0 to 0.482) when compared against other estimates of repeatability of T sel in the literature. Irrespective of how T sel was calculated, it showed inconsistent and variable temporal effects across species. Furthermore, repeatability of T sel did not change with acclimation to laboratory conditions. These data have implications for understanding the evolution of thermoregulation in these and other ectotherms.
Descriptors: reptiles, *Cordylus*, lizards, thermoregulation, coadaptation, inter individual variation, selection, temporal effects.

Colli, G.R., R.D. Teixeira, D.M. Scheltinga, D.O. Mesquita, H.C. Wiederhecker, and S.N. Bao (2007). **Comparative study of sperm ultrastructure of five species of teiid lizards (Teiidae, Squamata), and *Cercosaura ocellata* (Gymnophthalmidae, Squamata).** *Tissue and Cell* 39(1): 59-78. ISSN: 0040-8166.
Abstract: Sperm ultrastructure of five teiid lizards (*Callopistes flavipunctatus, Crocodilurus amazonicus, Dicrodon guttulatum, Dracaena guianensis* , and *Teius oculatus*), and the gymnophthalmid *Cercosaura ocellata* is described for the first time. Comparisons of sperm ultrastructure among these species and with those of previously examined teiids and gymnophthalmids revealed that the two groups of Teiioidea (Gymnophthalmidae and Teiidae), and the two subfamilies of Teiidae (Teiinae and Tupinambinae) could be distinguished on the basis of sperm ultrastructure data. Significant differences in sperm dimensions between Cnemidophorus and Aspidoscelis support the recent splitting of these two lineages into different genera. Our results revealed high levels of inter-generic variability in sperm ultrastructure within Teiidae, which produces a data set useful in analyzing relationships between genera and families. In phylogenetic analyses, however, sampling multiple species within teiid genera is essential and recording sperm measurements may profitably complement qualitative ultrastructural characters, maximizing the information content of these structures.
Descriptors: reptiles, teiid lizards, sperm ultrastructure, comparative study, sperm dimensions, differences, inter-generic variability.

Cowin, S. and J. Cebek (2006). **Feasibility of using plastron markings in young wood turtles (*Glyptemys insculpta*) as a technique for identifying individuals**. *Herpetological Review* 37(3): 305-307. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, wood turtles, *Glyptemys insculpta*, plastron markings, feasability, identifying individuals, technique.

Crews, D. and M.C. Moore (2005). **Historical contributions of research on reptiles to behavioral neuroendocrinology.** *Hormones and Behavior* 48(4): 384-394. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Abstract: Some of the first experiments in behavioral endocrinology in the 1930s were conducted with lizards, but events led to a hiatus that lasted for 30 years. In the 1960s,

research resumed using techniques current at the time, but it was not until the mid-1970s that behavioral neuroendocrinology "discovered" reptiles as animal model systems. This historical review summarizes this period of work, illustrating an enormous increase in research that have led to conclusions such as (1) the phenomenon of dissociated reproductive strategies and hormone-independent behaviors, which have aided our understanding of how the "memory" of sex steroid actions is maintained. (2) Progesterone plays an important role in the organization and activation of sexual behavior in males. Progesterone also synergizes with T to control male courtship much as does estrogen and progesterone to control sexual receptivity in females. Thus, progesterone is as much a "male" hormone as it is a "female" hormone. (3) Use of cytochrome oxidase histochemistry to study the role of experience over the long term in modifying brain activity. (4) Hormone manipulations as a powerful tool to test hypotheses about the evolution of behavior in free-living animals.
Descriptors: lizards, aggression, behavior, neuroendocrinology, reptiles, physiology, gonadal steroid hormones, history, 20th century research, neuroendocrinology methods, reproduction physiology, sex factors, sexual behavior.

Custodia Lora, N. and I.P. Callard (2002). **Progesterone and progesterone receptors in reptiles.** *General and Comparative Endocrinology* 127(1): 1-7. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: The role of progesterone (P) has been most extensively studied in the female reproductive tissues (ovary, reproductive tract, mammary gland) and in the brain, in which it is an important regulator and modulator in conjunction with estradiol (E). In nonmammalian vertebrate species, less work has been done on P metabolites involved in ovulation. In addition, P induces the expression of egg-white proteins, decreases myometrial contractility, and facilitates processing of eggs, formation of eggshell, and deposition of egg-white proteins. Actions of P may be synergistic with, or antagonist to, the actions of E, depending on hormone ratios, timing of exposure, and physiological state. These effects of P are mediated through progesterone receptor isoform A (PRA), a general transcription inhibitor of P target genes, and isoform B (PRB), a specific transcriptional stimulator of some reproductive tract genes. In this review, we focus on P action and PR expression in the liver and reproductive tissues of several reptilian species, especially Chelonia, since most of the data obtained are from this group. We also present novel data showing the expression of PR in nonreproductive tissues (such as kidney, spleen, gastrointestinal tract) in the painted turtle, *Chrysemys picta*.
Descriptors: reptiles, painted turtle, *Chrysemys picta*, progesterone, progesterone receptors, ovary, reproductive tract, brain, reproductive tissues.

D'Agostini, F.M., S.L.d.B. Ribeiro, and T. De Lema (2005). **A new method to prepare snake scale stratum corneum for epidermatoglyphics analyses using a scanning electron microscope.** *Comunicacoes Do Museu De Ciencias e Tecnologia Da PUCRS Serie Zoologia* 18(1): 53-56. ISSN: 0104-6950.
Descriptors: reptiles, snake scale stratum corneum, epidermatoglyphics, analyses, prepare, new method, scanning electron microscope.
Language of Text: Portuguese.

Davis, J.R. and D.F. Denardo (2007). **The urinary bladder as a physiological reservoir that moderates dehydration in a large desert lizard, the Gila monster *Heloderma suspectum*.** *Journal of Experimental Biology.* 210(Pt 8): 1472-1480. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.003061
NAL Call Number: 442.8 B77
Abstract: Animals inhabiting xeric environments use a variety of behavioral and physiological strategies to balance water budgets. We studied the potential contribution of the urinary bladder to osmoregulation in a large desert lizard, the Gila monster *Heloderma suspectum*. Here we present results of a series of in vivo laboratory experiments which tested the hypothesis that the Gila monster urinary bladder serves as a physiological reservoir, as in amphibians and chelonians, providing water that buffers increases in plasma osmolality when food and water are unavailable. Adult Gila monsters absorbed water from the urinary bladder into circulation and absorption of water from the urinary bladder and drinking water provided similar osmoregulatory benefits within 24 h, although drinking water provided a more immediate osmotic benefit. During food and water deprivation, plasma osmolality increased 2.5 times faster in lizards with an empty urinary bladder compared with those with a full bladder. During rehydration, stereotyped binge drinking behavior increased body mass nearly 22%, which resulted in a 24% reduction in plasma osmolality and a substantial increase in bladder water within 24 h. These results support our hypothesis and demonstrate for the first time in an adult lizard that the urinary bladder can function as a long-term physiological water reservoir. This trait can provide a critical benefit to osmoregulation during the 2- to 3-month summer dry season characteristic of the deserts that Gila monsters inhabit.
Descriptors: reptiles, lizards, Gila monster, urinary bladder, water budgets, osmoregulation, dehydration, physiological reservoir, plasma osmality.

Dawo, F. and K. Mohan (2007). **Development and application of an indirect ELISA test for the detection of antibodies to *Mycoplasma crocodyli* infection in crocodiles (*Crocodylus niloticus*).** *Veterinary Microbiology* 119(2-4): 283-289. ISSN: 0378-1135.
NAL Call Number: SF601.V44
Abstract: Non-availability of a standardized rapid serodiagnostic test for quick and accurate diagnosis of *Mycoplasma crocodyli* (*M. crocodyli*) infection in crocodiles was the underlining reason for conducting the present study. An indirect enzyme-linked immunosorbent assay (iELISA) for the detection of antibodies (Ab) to *M. crocodyli* infection in crocodile sera was developed using sonicated antigen (Ag) and anti-crocodile conjugate. The iELISA test was optimised with different reagents and at different steps. A cut-off value of percent positive greater than or equal to 53.47% resulted in an estimated sensitivity and specificity of 85.67 and 100%, respectively. The developed iELISA could be used for detection of Abs to *M. crocodyli* infection in crocodiles and may enable to understand the transmission of the disease.
Descriptors: retiles, crocodiles, *Micoplasma crocodyli*, test development, ELISA, detection of antibodies, quick, accurate, diagnosis.

Dearworth, J.R.J., L.J. Cooper, and C. McGee (2007). **Parasympathetic control of the pupillary light response in the red-eared slider turtle (*Pseudemys scripta elegans*).** *Veterinary Ophthalmology* 10(2): 106-110. ISSN: 1463-5216.

NAL Call Number: SF891.V47

Abstract: OBJECTIVE: We investigated effects of both vecuronium bromide, a nicotinic cholinergic antagonist, and atropine, a muscarinic cholinergic antagonist, on the pupil of the turtle to determine whether responses to light are controlled by parasympathetic innervations acting on the iris. ANIMAL STUDIED: Three red-eared slider turtles, *Pseudemys scripta elegans*. PROCEDURE: Turtles were secured to immobilize their head movements and then inserted into a light-integrating sphere. Both pupils were monitored through small apertures by digital video cameras. Pupil diameters were measured manually with a digital caliper. During each trial, drugs (0.4%) were topically applied, four times at 15 min intervals, to the corneas of each eye. One eye was randomly selected for treatment of the drug while the other, treated with saline (0.9% NaCl), was used as control. Pupil sizes under adaptation to light were tracked after drug or saline applications. RESULTS: Mean pupillary diameters of eyes treated with vercuronium bromide increased by 28%, reaching peak size in 90 min. Onset of response occurred 20 min after drug application and then increased at a rate having a time constant of 26 min. Recovery began at 120 min after initial application. Atropine had no effect on pupil size. No systemic side effects by drugs were observed in turtles. CONCLUSIONS: Although atropine does not cause mydriasis, vecuronium bromide does. These results suggest that the parasympathetic system in turtles acts through acetylcholine onto nicotinic receptors to stimulate pupillary light constriction.

Descriptors: reptiles, red-eared slider turtle, *Pseudemys scripta elegans*, pupillary light response, parasympathetic control, vecuronium bromide, atropine, pupil, iris , eye, adaption to light.

Delgado, S., M.L. Couble, H. Magloire, and J.Y. Sire (2006). **Cloning, sequencing, and expression of the amelogenin gene in two scincid lizards.** *Journal of Dental Research* 85(2): 138-143. ISSN: print: 0022-0345; online: 1544-0591.

Abstract: Our knowledge of the gene coding for amelogenin, the major enamel protein, is mainly based on mammalian sequences. Only two sequences are available in reptiles. To know whether the snake sequence is representative of the amelogenin condition in squamates, we have studied amelogenin in two scincid lizards. Lizard amelogenin possesses numerous conserved residues in the N- and C-terminal regions, but its central region is highly variable, even when compared with the snake sequence. This rapid evolution rate indicates that a single squamate sequence was not representative, and that comparative studies of reptilian amelogenins might be useful to detect the residues which are really important for amelogenin structure and function. Reptilian and mammalian enamel structure is roughly similar, but no data support amelogenin being similarly expressed during amelogenesis. By performing in situ hybridization using a specific probe, we showed that lizard ameloblasts express amelogenin as described during mammalian amelogenesis. However, we have not found amelogenin transcripts in odontoblasts. This indicates that full-length amelogenin is specific to enamel matrix, at least in this lizard.

Descriptors: lizard amelogenesis genetics, dental enamel proteins genetics, lizards genetics, reptilian proteins genetics, ameloblasts metabolism, amelogenin, amino acid sequence, base sequence, cloning, molecular, dental enamel proteins biosynthesis, dental enamel proteins

chemistry, gene expression, in situ hybridization, molecular sequence data, odontoblasts metabolism, sequence analysis, DNA.

Dong, S. and Y. Kumazawa (2005). **Complete mitochondrial DNA sequences of six snakes: phylogenetic relationships and molecular evolution of genomic features.** *Journal of Molecular Evolution* 61(1): 12-22. ISSN: print: 0022-2844; online: 14342-1432.
NAL Call Number: QH359.J6
Abstract: Complete mitochondrial DNA (mtDNA) sequences were determined for representative species from six snake families: the acrochordid little file snake, the bold boa constrictor, the cylindrophiid red pipe snake, the viperid himehabu, the pythonid ball python, and the xenopeltid sunbeam snake. Thirteen protein-coding genes, 22 tRNA genes, 2 rRNA genes, and 2 control regions were identified in these mtDNAs. Duplication of the control region and translocation of the tRNALeu gene were two notable features of the snake mtDNAs. The duplicate control regions had nearly identical nucleotide sequences within species but they were divergent among species, suggesting concerted sequence evolution of the two control regions. In addition, the duplicate control regions appear to have facilitated an interchange of some flanking tRNA genes in the viperid lineage. Phylogenetic analyses were conducted using a large number of sites (9570 sites in total) derived from the complete mtDNA sequences. Our data strongly suggested a new phylogenetic relationship among the major families of snakes: ((((Viperidae, Colubridae), Acrochordidae), (((Pythonidae, Xenopeltidae), Cylindrophiidae), Boidae)), Leptotyphlopidae). This conclusion was distinct from a widely accepted view based on morphological characters in denying the sister-group relationship of boids and pythonids, as well as the basal divergence of nonmacrostomatan cylindrophiids. These results imply the significance to reconstruct the snake phylogeny with ample molecular data, such as those from complete mtDNA sequences.
Descriptors: snakes, DNA, mitochondrial genetics , evolution, molecular, phylogeny, snakes genetics, gene rearrangement, RNA, ribosomal genetics, transfer genetics, DNA, sequences.

Dutton, C.J. and P. Taylor (2003). **A comparison between pre- and posthibernation morphometry, hematology, and blood chemistry in viperid snakes.** *Journal of Zoo and Wildlife Medicine* 34(1): 53-58. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Abstract: Snakes from temperate climates are often made to hibernate in zoos to stimulate reproduction. Unfortunately, deaths have occurred during and after hibernation. This study evaluated the health status, pre- and posthibernation, of 31 adult viperid snakes. It included morphometric measurements, hematology, and blood chemistry. No differences were seen in body weights and weight to length ratios between pre- and posthibernation examinations, suggesting that the overall condition of the snakes did not change. No differences were seen in hematologic and blood chemistry parameters, except that bile acids (3alpha-hydroxybile acids) decreased, the implications of which are unknown. Three individuals had markedly high plasma uric acid levels posthibernation; of these, two individuals died from extensive visceral gout and one recovered with fluid therapy. Viperid snakes should be clinically healthy, well hydrated, and in good body condition when they are put into hibernation. They should be maintained in an environment with sufficient humidity and should have access to

water. Blood samples should be collected on arousal for measuring plasma uric acid levels. Changes in morphometry, hematology, and blood chemistry appear to be abnormal and should be investigated thoroughly.
Descriptors: reptiles, viperid snakes, prehibernation, posthibernation, comparison hematology, blood chemistry, morphometry.

Elf, P.K. (2003). **Yolk steroid hormones and sex determination in reptiles with TSD.** *General and Comparative Endocrinology* 132(3): 349-355. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: In reptiles with temperature-dependent sex determination (TSD), the temperature at which the eggs are incubated determines the sex of the offspring. The molecular switch responsible for determining sex in these species has not yet been elucidated. We have examined the dynamics of yolk steroid hormones during embryonic development in the snapping turtle, *Chelydra serpentina*, and the alligator, *Alligator mississippiensis*, and have found that yolk estradiol (E(2)) responds differentially to incubation temperature in both of these reptiles. Based upon recently reported roles for E(2) in modulation of steroidogenic factor 1, a transcription factor known to be significant in the sex differentiation process, we hypothesize that yolk E(2) is a link between temperature and the gene expression pathway responsible for sex determination and differentiation in at least some of these species. Here we review the evidence that supports our hypothesis.
Descriptors: reptiles, snapping turtle, alligator, sex determination , incubation temperature, yolk steroid hormones, dynamics, embryonic development.

Endo, H., R. Aoki, H. Taru, J. Kimura, M. Sasaki, M. Yamamoto, K. Arishima, and Y. Hayashi (2002). **Comparative functional morphology of the masticatory apparatus in the long-snouted crocodiles.** *Anatomia, Histologia, Embryologia* 31(4): 206-213. ISSN: print: 0340-2096; online: 1439-0264.
Abstract: The masticatory muscles and their related structures of the skull were observed in the Indian gavial (*Gavialis gangeticus*), the false gavial (*Tomistoma schlegelii*), and the African slender-snouted crocodile (*Mecistops cataphractus*) to detail some morphological differences in comparison with the other crocodile species, and to compare and elucidate the functional strategy of themasticatory apparatus in these long-snouted species. The Musculus pterygoideus posterior was relatively smaller in the three species compared with many short-snouted crocodiles. It suggests that the masticatory power in fish-eating long-snouted species is not so high as in the short-snouted crocodiles, while the masticatory muscles were morphologically different among the three long-snouted species as follows. The M. pterygoideus posterior of the false gavial was extended in the lateral side of the lower jaw unlike the Indian gavial. The M. pseudotemporalis and the Fenestra supratemporalis were largely developed in the Indian gavial, however we suggest that the other two species possess the weak bundles in this muscle. The false gavial and the African slender-snouted crocodile have the pterygoid bone well-developed extending dorso-ventrally and it is suggested that the M. adductor mandibulae posterior attached to the pterygoid bone may be much larger than the Indian gavial. These data morphologically clarify the masticatory mechanism in the long-snouted crocodiles different from the short-snouted species, and demonstrate that the evolutional strategy to share

the functional role in the masticatory muscles have been differently established between the Indian gavial and the other two species. We also obtained the morphological data in the fossil skull of the Machikane crocodile (*Toyotamaphymeia machikanense*) and concluded from the fossil characters that the considerable developments of the M.pterygoideus posterior and the M.pseudotemporalis in this species had not morphologically been consistent with both the Indian and false gavials.

Descriptors: reptiles, long snouted crocodiles, masticatory apparatus, functional morphology, comparative, Indian gavial, false gaval, slender snouted crocodile, masticatory muscles.

Ezaz, T., A.E. Quinn, I. Miura, S.D. Sarre, A. Georges, and J.A. Marshall Graves (2005). **The dragon lizard *Pogona vitticeps* has ZZ/ZW micro-sex chromosomes.** *Chromosome Research* 13(8): 763-776. ISSN: print: 0967-3849; online: 1573-6849.

NAL Call Number: QH600.C47

Abstract: The bearded dragon, *Pogona vitticeps* (Agamidae: Reptilia) is an agamid lizard endemic to Australia. Like crocodilians and many turtles, temperature-dependent sex determination (TSD) is common in agamid lizards, although many species have genotypic sex determination (GSD). *P. vitticeps* is reported to have GSD, but no detectable sex chromosomes. Here we used molecular cytogenetic and differential banding techniques to reveal sex chromosomes in this species. Comparative genomic hybridization (CGH), GTG- and C-banding identified a highly heterochromatic microchromosome specific to females, demonstrating female heterogamety (ZZ/ZW) in this species. We isolated the *P. vitticeps* W chromosome by microdissection, re-amplified the DNA and used it to paint the W. No unpaired bivalents were detected in male synaptonemal complexes at meiotic pachytene, confirming male homogamety. We conclude that *P. vitticeps* has differentiated previously unidentifable W and Z micro-sex chromosomes, the first to be demonstrated in an agamid lizard. Our finding implies that heterochromatinization of the heterogametic chromosome occurred during sex chromosome differentiation in this species, as is the case in some lizards and many snakes, as well as in birds and mammals. Many GSD reptiles with cryptic sex chromosomes may also prove to have micro-sex chromosomes. Reptile microchromosomes, long dismissed as non-functional minutiae and often omitted from karyotypes, therefore deserve closer scrutiny with new and more sensitive techniques.

Descriptors: bearded dragon, *Pogona vitticeps*, lizards genetics, sex chromosomes, sex determination, chromosome banding, karyotyping, microdissection, nucleic acid hybridization, sex differentiation.

Ezaz, T., N. Valenzuela, F. Grutzner, I. Miura, A. Georges, R.L. Burke, and J.A. Graves (2006). **An XX/XY sex microchromosome system in a freshwater turtle, *Chelodina longicollis* (Testudines: Chelidae) with genetic sex determination.** *Chromosome Research* 14(2): 139-150. ISSN: print: 0967-3849; online: 1573-6849.

NAL Call Number: QH600.C47

Abstract: Heteromorphic sex chromosomes are rare in turtles, having been described in only four species. Like many turtle species, the Australian freshwater turtle *Chelodina longicollis* has genetic sex determination, but no distinguishable (heteromorphic) sex chromosomes were identified in a previous karyotyping study. We used comparative genomic hybridization

(CGH) to show that *C. longicollis* has an XX/XY system of chromosomal sex determination, involving a pair of microchromosomes. C-banding and reverse fluorescent staining also distinguished microchromosomes with different banding patterns in males and females in approximately 70% cells examined. GTG-banding did not reveal any heteromorphic chromosomes, and no replication asynchrony on the X or Y microchromosomes was observed using replication banding. We conclude that there is a very small sequence difference between X and Y chromosomes in this species, a difference that is consistently detectable only by high-resolution molecular cytogenetic techniques, such as CGH. This is the first time a pair of microchromosomes has been identified as the sex chromosomes in a turtle species.
Descriptors: fresh water turtle, *Chelodina longicollis*, sex chromosomes genetics, sex determination genetics, turtles genetics, chromosome banding, karyotyping, nucleic acid hybridization, sex differentiation, staining and labeling.

Fahrig, B.M., M.A. Mitchell, B.E. Eilts, and D.L. Paccamonti (2007). **Characterization and cooled storage of semen from corn snakes (*Elaphe guttata*).** *Journal of Zoo and Wildlife Medicine* 38(1): 7-12. ISSN: 1042-7260.
Abstract: The phylogenetic order Squamata has many representatives that could benefit from the use of semen preservation as a tool for assisting conservation. To date, few studies have been made evaluating the potential for collecting and preserving semen from snakes. The objectives of this study were to characterize semen parameters of the corn snake (*Elaphe guttata*), including appearance, volume, concentration, sperm motility, and sperm morphology, and to determine the longevity of corn snake sperm motility stored at 4 degrees C. Single semen samples were collected from 22 adult corn snakes. The appearance of the corn snake semen was generally cloudy, and the color was white to tan. Corn snake spermatozoa initially exhibited a median motility of 92.5%. Corn snakes were found to produce small-volume ejaculates (median 0.01 ml). However, the overall concentration of the snake ejaculate was high (chi = 852 x 10(6) +/- 585 x 10(6) spermatozoa/ml). Morphologically, a mean of 75.7 +/- 9.3% of the sperm cells in an ejaculate were normal. Snake ejaculate with a white appearance had significantly higher sperm concentrations (chi = 1,859 x 10(6) +/- 1,008 x 106 sperm cells/ml; F = 15.74, P = 0.001) than tan ejaculates (chi = 601 x 10(6) +/- 439 x 106 sperm cells/ml). Sperm motility decreased significantly in samples that were stored at 4 degrees C for greater than 48 hr in a refrigerator or Equitainer I. This is the first study to characterize semen volume, appearance, and concentration; sperm motility; and sperm morphology in captive corn snakes. The information derived from this study can be used to develop a model for a collection, cooled storage, and shipping program for semen from endangered or threatened captive and wild snakes.
Descriptors: reptiles, corn snakes, *Elaphe guttata*, cooled storage semen, characterization, semen preservation, sperm morphology, shipping, conservation.

Ferreira, A. and H. Dolder (2002). **Ultrastructural analysis of spermiogenesis in *Iguana iguana* (Reptilia: Sauria: Iguanidae).** *European Journal of Morphology* 40(2): 89-99. ISSN: print: 0924-3860; online: 1744-4241.
Abstract: Spermiogenesis in the lizard, *Iguana iguana*, was studied by transmission and scanning electron microscopy. During this process, structures such as the acrosomal complex

in the spermatid head and the axonemal complex in the mid and principal pieces of the flagellum are formed. The nuclear content is initially compacted into thick, longitudinal chromatin filaments. Nuclear shape is determined by further compaction and by the manchette, a layer of microtubules surrounding the head. The acrosomal complex originates from Golgi vesicles and the interaction between the proacrosomal vesicle and the nucleus. The midpiece consists of a pair of centrioles, surrounded by a fibrous sheath and rings of simple and modified mitochondria. The centrioles sustain the axoneme that appears at the end of the midpiece. The axoneme extends throughout the principal piece of the flagellum with the 9 + 2 pattern, still surrounded by the fibrous sheath. In the endpiece, the axoneme continues, surrounded only by the plasma membrane. In the lumen of seminiferous tubules, immature spermatozoa retain abundant residual cytoplasm.
Descriptors: reptiles, *Iguana*, spermiogenesis, ultrastructureal analysis, scanning electron microscopy.

Foa, A. and C. Bertolucci (2003). **Toward a seasonal model of the circadian system: The case of Ruin lizards.** *Frontiers in Bioscience* 8: S236-S242. ISSN: print: 1093-9946; online: 1093-4715.
Online: http://dx.doi.org/10.2741/1037
Abstract: The pineal gland plays a role in the seasonal re-organization of the circadian system that occurs in Ruin lizard *Podarcis sicula*. In fact, either pinealectomy or melatonin implants induce an immediate transition from the circadian locomotor pattern typical of summer to the circadian locomotor pattern typical of spring or autumn. Furthermore, the degree of involvement of melatonin and the pineal in circadian organization changes dramatically with season: 1. The effects of pinealectomy, as well as those of melatonin implants on circadian locomotor rhythms are strong in summer and weak in the other seasons; 2. Daily melatonin injections entrain locomotor rhythms in summer, but not in other seasons; 3. A phase response curve for melatonin was generated in summer, but not in winter; 4. Daily injections of luzindole, an antagonist for melatonin receptors alter locomotor rhythms in summer, but not in other seasons; 5. A robust pineal-dependent circadian rhythm of circulating melatonin exists in summer, but not in spring or in autumn. This confirms that the central role of the pineal in determining circadian organization in summer and the marginal role of the pineal in either spring or autumn are respectively due to appearance (summer) or disappearance (spring, autumn) of a circadian melatonin signal in the circulation.
Descriptors: reptiles, Ruin lizard *Podarcis sicula* , circadian rhythm physiology, lizards physiology, models, biological, seasons.

Foa, A., R. Brandstatter, and C. Bertolucci (2006). **The circadian system of ruin lizards: a seasonally changing neuroendocrine loop?** *Chronobiology International* 23(1-2): 317-327. ISSN: print: 0742-0528; online: 1525-6073.
Abstract: Previous studies have shown that the amplitude of daily melatonin production in cultured ruin lizard pineal organs explanted in the summer is significantly higher than that from organs explanted in the winter. To test whether seasonal photoperiodic changes are decoded autonomously by the pineal gland, pineals explanted in summer were cultured in vitro and exposed to changes between winter and summer photoperiods. The changes in

photoperiod duration did not affect the daily profiles of in vitro melatonin production. The discrepancy between the present in vitro results and those from lizards exposed to winter or summer photoperiods before pineal explantation supports the view that circadian information entering the pineal gland via its innervation is involved in determining seasonal changes of melatonin production in ruin lizards. We further examined whether a central component of the circadian system of ruin lizards, specifically the retinae of the lateral eyes, expresses similar seasonal changes in function as does the pineal gland. We did not find any difference between summer and autumn-winter in the effectiveness of either bilateral retinalectomy or optic nerve lesion-at the level of the optic chiasm-in altering circadian locomotor behavior in constant conditions. Both surgical procedures mostly induced a shortening of the free-running period of the locomotor rhythm of similar magnitude in all seasons. Thus, the retinae do not appear to participate in the seasonal reorganization of the circadian system in ruin lizards.

Descriptors: ruin lizards, circadian rhythm, pineal gland anatomy and histology, behavior, animal, lizards, melatonin metabolism, neurosecretory systems, photoperiod, pineal gland metabolism, retina embryology, seasons, suprachiasmatic nucleus physiology, time factors.

Ford, S.S. and S.D. Bradshaw (2006). **Kidney function and the role of arginine vasotocin in three agamid lizards from habitats of differing aridity in Western Australia.** *General and Comparative Endocrinology* 147(1): 62-69. ISSN: 0016-6480.

NAL Call Number: 444.8 G28

Abstract: Western Australian agamid lizards are diverse and inhabit mesic to very arid areas of the state. Although reptilian kidneys are unable to elaborate hyperosmotic urine, we hypothesised that the renal system of lizards inhabiting arid areas would display an enhanced ability to conserve water under the control of the antidiuretic peptide hormone, arginine vasotocin (AVT). To examine this, the renal physiological and endocrine responses to osmotic challenge in three closely-related Australian agamid lizards inhabiting arid, semi-arid, and mesic environments were studied. The species studied were *Pogona minor* (mesic), *Ctenophorus salinarum* (semi-arid), and *Ctenophorus nuchalis* (arid). Circulating AVT was assayed and renal variables such as glomerular filtration rate (GFR), urine flow rate (V), and fractional reabsorption of filtrate FRH2O were measured in response to hypernatraemia, water load, and dehydration. Hypernatraemia and dehydration induced antidiuresis in all three species through similar mechanisms involving both glomerular and tubular responses. However, in salt-loaded *P. minor* the response was largely glomerular in nature, as FRH2O did not increase relative to the hydrated condition. The magnitude of the antidiuretic response was also greater in *P. minor*, indicating a greater sensitivity to osmotic challenge. Plasma concentrations of AVT were significantly correlated with FRH2O in *P. minor* (r2=0.38, P=0.025), but with GFR in *C. nuchalis* (r2=0.16, P=0.041). We found that the control and mechanisms of renal function among these lizards were largely similar, and there was little support for the hypothesis that arid lizards possess physiological adaptations not present in closely-related mesic lizards. Yet, differences remain in their response to hypernatraemia which may reflect the aridity of their different environments, or their varying habits.

Descriptors: Western Australian agamid lizards, kidney physiology, lizards physiology , vasotocin physiology, water electrolyte balance, acclimatization, body water metabolism,

dehydration, desert climate, environment, lizards metabolism, osmolar concentration, receptors, vasopressin metabolism, vasopressins metabolism, vasotocin blood, Western Australia.

Francisco Morcillo, J., M. Hidalgo Sanchez, and G. Martin Partido (2006). **Spatial and temporal patterns of proliferation and differentiation in the developing turtle eye.** *Brain Research* 1103(1): 32-48. ISSN: 0014-4819.

Abstract: Here we show for the first time different aspects of the pattern of neurogenesis in the developing turtle retina by using different morphological and molecular clues. We show the chronotopographical fashion of occurrence of three major aspects of retinal development: (1) morphogenesis of the optic primordia and emergence of the different retinal layers, (2) the temporal progression of neurogenesis by the cessation of proliferative activity, and (3) the apparition and cellular localization of different antigens and neuroactive substances. Retinal cells were generated in a conserved temporal order with ganglion cells born first, followed by amacrine, photoreceptor, horizontal and bipolar/Muller cells. While eventually expressed in many types of retinal neurons, Islet1 was permanently expressed in differentiating and mature ganglion cells. Calbindin-immunoreactive elements were found in the ganglion cell layer and the inner nuclear layer. Interestingly, at later stages the amount of expressing cells in these layers was reduced dramatically. On the contrary, the number of calbindin-immunoreactive photoreceptors increased as development proceeded. In addition, calretinin expressing cells were prominent in the horizontal cell bodies, and their processes extending into the outer plexiform layer were also strongly labeled. Finally, the synthesis of gamma-aminobutyric acid (GABA) was detected in developing and matured horizontal and amacrine cells. All these maturational features began in the dorso-central area, in a region slightly displaced towards the temporal retina.

Descriptors: reptiles, developing turtle eye, spatial, temporal, patterns, proliferation, differentiation, retina, neurogenesis.

Franklin, C.E., B.M. Davis, S.K. Peucker, H. Stephenson, R. Mayer, J. Whittier, J. Lever, and G.C. Grigg (2003). **Comparison of stress induced by manual restraint and immobilisation in the estuarine crocodile, *Crocodylus porosus*.** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 298(2): 86-92. ISSN: print: 1548-8969; online: 1552-499X.

NAL Call Number: QL1.J854

Descriptors: reptiles, estuarine crocodile , *Crocodylus porosus*, stress, manual restraint, immobilization, electrostunning, comparison, handling methods.

Frappell, P.B., T.J. Schultz, and K.A. Christian (2002). **The respiratory system in varanid lizards: determinants of O(2) transfer.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 133(2): 239-258. ISSN: 1095-6433.

Abstract: Varanids in general exhibit greater aerobic capacities than other lizards. In a similar approach to the extensive investigations undertaken in mammals, the respiratory system in varanids is examined in terms of oxygen transfer from the air to the blood during rest and sustained locomotory activity. The parameters controlling the transfer of O(2) through the various steps of the respiratory system are appropriate to meet the maximum demands for oxygen with one possible exception, circulatory convection. Ventilatory convection is main-

tained during maximal aerobic locomotion ensuring adequate pulmonary ventilation and the protection of alveolar P(O(2)). Little evidence exists to indicate a mechanically imposed constraint to breathe and the possibility of a gular pump acting to assist ventilation, as a general feature of varanids remains to be determined. Alterations in the relative contributions of the ventilation-perfusion ratio, pulmonary diffusion, diffusion equilibrium and right-left shunts preserved the alveolar-arterial P(O(2)) difference, ensuring that arterial oxygenation was maintained. In those species where increases in cardiac output were limited, maximum O(2) transfer was achieved through increased extraction of oxygen at the tissues. Overall, the interrelationship of adjacent steps in the respiratory system ensures that one step cannot become limiting. Compensatory changes occur in various parameters to offset those parameters that are 'limited'. The high aerobic activity of varanid lizards would not be achievable without a compensated circulatory convection.
Descriptors: reptiles, varanid lizards, respiratory system, oxygen transfer, aerobic capacities, blood, air.

Gehr, D.D. and Y.L. Werner (2005). **Age effects and size effects in the ears of gekkonomorph lizards: Inner ear.** *Hearing Research* 200(1-2): 38-50. ISSN: 0378-5955.
Abstract: Audiograms have indicated greater auditory sensitivity in larger than in smaller geckos; part of this difference, interspecifically and intraspecifically, is explained by middle-ear proportions. To investigate the contribution of the inner ear to the variation in sensitivity, we examined it in museum specimens representing 11 species and three subfamilies. We measured papilla basilaris length, and, when intact, the saccular otoconial mass. Papilla length approximated 1% of rostrum-anus length in large geckos but 2% in small geckos; in some species some inter-aural difference was indicated. Over the lumped material, relative papilla length varied as a function of body length, with highly significant correlation. Similar relations prevailed within each subfamily. However, intraspecifically the correlation of papilla basilaris length with animal size was usually nonsignificant. Hair cell populations assessed from SEM photographs were larger in the larger species but intraspecifically did not relate to an individual's size. Hence interspecifically, the dependence of auditory sensitivity on animal size seems supported by inner-ear differences but intraspecifically this relation derives only from the middle ear. Otoconial mass, as measured by its volume, was correlated with animal length both interspecifically and intraspecifically.
Descriptors: reptiles, gecko lizard, inner ear anatomy, age factors, body size, cochlear duct, hair cells, organ of Corti.

Girondot, M., P. Rivalan, R. Wongsopawiro, J.P. Briane, V. Hulin, S. Caut, E. Guirlet, and M.H. Godfrey (2006). **Phenology of marine turtle nesting revealed by statistical model of the nesting season**. *BMC Ecology* 6: 11. ISSN: 1472-6785.
Online: http://dx.doi.org/10.1186/1472-6785-6-11
Descriptors: reptiles, marine turtle, nesting, phenology, statistical model, nesting season, eggs, mathematical model.

Giugliano, L.G., R.D. Teixeira, G.R. Colli, and S.N. Bao (2002). **Ultrastructure of spermatozoa of the lizard *Ameiva ameiva*, with considerations on polymorphism within the family Teiidae (Squamata).** *Journal of Morphology* 253(3): 264-271. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: reptiles, lizard, *Ameiva ameiva*, spermatozoa, ultrastructure, polymorphism, family Teiidae.

Gordos, M.A., C.E. Franklin, C.J. Limpus, and G. Wilson (2004). **Blood-respiratory and acid-base changes during extended diving in the bimodally respiring freshwater turtle *Rheodytes leukops*.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 174(4): 347-354. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: Changes in blood-gas, acid-base, and plasma-ion status were investigated in the bimodally respiring turtle, *Rheodytes leukops*, during prolonged dives of up to 12 h. Given that *R. leukops* routinely submerges for several hours, the objective of this study was to determine whether voluntarily diving turtles remain aerobic and simultaneously avoid hypercapnic conditions over increasing dive lengths. Blood PO(2), PCO(2), and pH, as well as plasma concentrations of lactate, glucose, Na(+), K(+), Cl(-), total Ca, and total Mg were determined in venous blood collected from the occipital sinus. Blood PO(2) declined significantly with dive length; however, oxy-haemoglobin saturation remained greater than 30% for all *R. leukops* sampled. No changes were observed in blood PCO(2), pH, [HCO(3)(-)], or plasma glucose, with increasing dive length. Despite repeated dives lasting more than 2 h, plasma lactate remained less than 3 mmol l(-1) for all R. leukops sampled, indicating the absence of anaerobiosis. Compensatory acid-base adjustments associated with anaerobiosis (e.g. declining [Cl(-)], increasing total [Ca] and [Mg]) were likewise absent, with plasma-ion concentrations remaining stable with increasing dive length. Results indicate that *R. leukops* utilises aquatic respiration to remain aerobic during prolonged dives, thus effectively avoiding the development of a metabolic and respiratory acidosis.
Descriptors: reptiles, freshwater turtle, *Rheodytes leukops*, extended diving, acid-base changes, blood-respiratory, bimodally respiring.

Gordos, M.A., C.J. Limpus, and C.E. Franklin (2006). **Response of heart rate and cloacal ventilation in the bimodally respiring freshwater turtle, *Rheodytes leukops* to experimental changes in aquatic PO2.** *Journal of Comparative Physiology B Biochemical Systemic and Environmental Physiology* 176(1): 65-73. ISSN: 0174-1578.
NAL Call Number: QP33.J681
Descriptors: reptiles, freshwater turtle, *Rheodytes leukops*, heart rate, coacal ventilation, response, experimental changes, aquatic PO2, bimodal respiration.

Gorman, R.B., J.C. McDonagh, T.G. Hornby, R.M. Reinking, and D.G. Stuart (2005). **Measurement and nature of firing rate adaptation in turtle spinal neurons.** *Journal of Comparative Physiology. A, Neuroethology, Sensory, Neural, and Behavioral Physiology* 191(7): 583-603. ISSN: 0340-7594.
NAL Call Number: QP33.J68

Abstract: There is sparse literature on the profile of action potential firing rate (spike-frequency) adaptation of vertebrate spinal motoneurons, with most of the work undertaken on cells of the adult cat and young rat. Here, we provide such information on adult turtle motoneurons and spinal ventral-horn interneurons. We compared adaptation in response to intracellular injection of 30-s, constant-current stimuli into high-threshold versus low-threshold motoneurons and spontaneously firing versus non-spontaneously-firing interneurons. The latter were shown to possess some adaptive properties that differed from those of motoneurons, including a delayed initial adaptation and more predominant reversal of adaptation attributable to plateau potentials. Issues were raised concerning the interpretation of changes in the action potentials' afterhyperpolarization shape parameters throughout spike-frequency adaptation. No important differences were demonstrated in the adaptation of the two motoneuron and two interneuron groups. Each of these groups, however, was modeled by its own unique combination of action potential shape parameters for the simulation of its 30-s duration of spike-frequency adaptation. Also, for a small sample of the very highest-threshold versus lowest-threshold motoneurons, the former group had significantly more adaptation than the latter. This finding was like that shown previously for cat motoneurons supplying fast- versus slow twitch motor units.
Descriptors: turtle, spinal neurons, firing rate, adaptation, measurement, action potentials, spinal cord physiology, anterior horn cells physiology, spinal cord cytology.

Guillory, K.S., S. Shoham, and R.A. Normann (2006). **Discrete stimulus estimation from neural responses in the turtle retina.** *Vision Research* 46(12): 1876-1885. ISSN: 0042-6989.
Abstract: In this paper, we investigate the decoding of flashed, full-field visual stimuli while recording from a population of retinal ganglion cells. We present a direct statistical method for determining the likelihood that a response was evoked by a particular stimulus, and use this method to estimate stimuli based on microelectrode array recordings in the turtle retina. This method uses the well-known time-varying Poisson model of neural firing, along with extensions to accommodate neural refractory periods. Unlike other approaches commonly used for Poisson processes, the specific formulation presented here is bin free and requires few user-specified parameters. Statistical dependency issues and the effects of stationarity on the estimation method are also discussed.
Descriptors: turtles, models neurological, retinal ganglion cells physiology, turtles physiology, action potentials physiology, microelectrodes, photic stimulation methods, stochastic processes.

Guirado, S. and J.C. Davila (2002). **Thalamo-telencephalic connections: new insights on the cortical organization in reptiles.** *Brain Research Bulletin* 57(3-4): 451-454. ISSN: 0361-9230.
Abstract: Tracer injections into the dorsal tier of the lacertilian dorsal thalamus revealed an extensive innervation of the cerebral cortex. The medial cortex, the dorsomedial cortex, and the medial part of the dorsal cortex received a bilateral projection, whereas the lateral part of dorsal cortex and the dorsal part of the lateral cortex received only an ipsilateral thalamic projection. Thalamocortical fibers were found superficially in all cortical regions, but in the dorsal part of the lateral cortex, varicose axons within the cellular layer were also observed. The bilateral thalamocortical projection originates from a cell population located through-

out the dorsolateral anterior nucleus, whereas the ipsilateral input originates mainly from a rostral neuronal subpopulation of the nucleus. This feature suggests that the dorsolateral anterior nucleus consists of various parts with different projections. The dorsal subdivision of the lateral cortex displayed hodological and topological (radial glia processes) features of a dorsal pallium derivative. After tracer injections into the dorsal cortex of lizards, we found long descending projections that reached the striatum, the diencephalic basal plate, and the mesencephalic tegmentum, which suggests that it may represent a sensorimotor cortex.
Descriptors: reptiles, cortical organization, thalamo-telencephalic connections, new insights.

Halpern, M., A.R. Cinelli and D. Wang (2005). **Prey chemical signal transduction in the vomeronasal system of garter snakes.** In: R.T. Mason, M.P. LeMaster and D. Mueller-Schwarze (Editors), *Chemical Signals in Vertebrates 10,* Springer Science+Business Media, Inc.: New York, NY, p. 242-255. ISBN: 0387251596.
NAL Call Number: QP455 .I54 2003
Descriptors: reptiles, garter snakes, vomeronasal system, prey chemical signal transduction.

Hammerton, K.M., N. Jayasinghe, R.A. Jeffree, and R.P. Lim (2003). **Experimental study of blood lead kinetics in estuarine crocodiles (*Crocodylus porosus*) exposed to ingested lead shot.** *Archives of Environmental Contamination and Toxicology* 45(3): 390-398. ISSN: 0090-4341.
NAL Call Number: TD172.A7
Descriptors: reptiles, *Crocodylus porosus*, crocodiles, estuaries, blood, lead shot toxicity, lead poisoning, kinetics, ingestion, in vitro studies, hematologic tests, blood chemistry, intestinal absorption, digestion , digestive system, stomach, bioaccumulation.

Hanley, C.S., S.J. Hernandez Divers, S. Bush, and K.S. Latimer (2004). **Comparison of the effect of dipotassium ethylenediaminetetraacetic acid and lithium heparin on hematologic values in the green iguana (*Iguana iguana*).** *Journal of Zoo and Wildlife Medicine* 35(3): 328-332. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Abstract: We compared the effects of dipotassium ethylenediaminetetraacetic acid (EDTA) and lithium heparin on hematologic values of green iguanas (*Iguana iguana*). Thirty-two privately owned sibling iguanas had blood drawn, and the sample was divided into three components: an EDTA tube, a heparin tube, and a nonanticoagulated blood smear. A full reptilian complete blood count was performed on each anticoagulated sample, and white blood cell (WBC) and leukocyte differential counts were performed on the whole-blood smears. Heparin and EDTA samples differed significantly in absolute values of thrombocytes, WBC, heterophils, and monocytes. The EDTA had no significant effect on the packed cell volume or plasma protein values, and the white blood count and differential counts produced with EDTA were more similar to those of the nonanticoagulated blood smear than were the counts produced with heparin.
Descriptors: reptiles, green iguana, hematologic values, dipotassium ethylenediaminetetraacetic acid, lithium heparin, anticoagulants, effects, blood count.

Harms, C.A., K.M. Mallo, P.M. Ross, and A. Segars (2003). **Venous blood gases and lactates of wild loggerhead sea turtles (*Caretta caretta*) following two capture techniques.** *Journal of Wildlife Diseases* 39(2): 366-374. ISSN: 0090-3558.

NAL Call Number: 41.9 W64B

Abstract: During summer of 2001, venous blood gases were determined in loggerhead sea turtles (*Caretta caretta*) captured by trawl (n = 16) in coastal waters of South Carolina and Georgia (USA) as part of a sea turtle census program and captured in pound nets (n = 6) in coastal North Carolina (USA) during a study of sea turtle population biology. Trawls were towed for 30 min, so turtles captured were forcibly submerged for < or = 30 min. Pound nets are passive gear in which fish and sea turtles are funneled into a concentrated area and removed periodically. Sea turtles in pound nets are free to surface and to feed at will. Blood was obtained from the dorsal cervical sinus as quickly as possible after landing on the boat (range 2-10 min trawl, 1-2 min pound net) and at 30 min after landing just prior to release. Blood gases including pH, partial pressures of O2 and CO2 (pO2, pCO2), and lactate were measured within 10 min. Instrument measurements for pH, pO2, and pCO2 made at 37 C were corrected to cloacal temperature and HCO3- was calculated from temperature-corrected pH and pCO2. Venous blood pH and bicarbonate were higher, and pO2 and lactate were lower from pound net-captured turtles compared to trawl captured turtles at the initial sampling time. In pound net turtles, pH and bicarbonate declined and lactate increased during 30 min on deck. In trawled sea turtles, venous blood pH increased and pCO2 and pO2 decreased during the 30 min on deck. Both capture systems caused perturbations in blood gas, acid-base, and lactate status, though alterations were greater in trawl captured turtles.

Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, wild, capture techniques, venous blood gases, lactates, acid-base.

Harms, C.A., M.G. Papich, M.A. Stamper, P.M. Ross, M.X. Rodriguez, and A.A. Hohn (2004). **Pharmacokinetics of oxytetracycline in loggerhead sea turtles (*Caretta caretta*) after single intravenous and intramuscular injections.** *Journal of Zoo and Wildlife Medicine* 35(4): 477-488. ISSN: 1042-7260.

NAL Call Number: SF601.J6

Abstract: The pharmacokinetics of oxytetracycline in 2-yr-old loggerhead sea turtles (*Caretta caretta*) after single i.v. and i.m. injections were studied for biologic marking and therapeutic applications. Twenty juvenile turtles were divided into two treatment groups. Ten animals received 25 mg/kg of oxytetracycline i.v. and 10 received the same dosage i.m. Plasma oxytetracycline concentrations were analyzed by reverse-phase high-performance liquid chromatography. Data from the i.v. route best fit a three-compartment model, whereas noncompartmental analysis was used to compare data from both the i.v. and i.m routes. For the i.v. route, means for maximum plasma concentration, terminal phase half-life, systemic clearance, and apparent volume of distribution at steady state were 6.6 microg/ml, 66.1 hr, 290.7 ml/hr/kg, and 18.4 L, respectively. For the i.m. route, means for systemic availability, maximum plasma concentration, and elimination half-life were 91.8%, 1.6 microg/ml, and 61.9 hr, respectively. The remarkably high apparent volume of distribution may possibly be associated with a deep compartment of drug disposition such as bone deposition associated

with the large skeletal mass of turtles and the fact that these were well-nourished, growing juveniles. Although maximum plasma concentration by i.m. administration was lower than for the i.v. route, the long elimination time indicates that an infrequent dosing interval may be effective for sensitive bacteria.

Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, oxytetracycline, pharmacokinetics, intravenous, intramuscular, single injections.

Harms, H.K., R.T. Paitz, R.M. Bowden, and F.J. Janzen (2005). **Age and season impact resource allocation to eggs and nesting behavior in the painted turtle.** *Physiological and Biochemical Zoology* 78(6): 996-1004. ISSN: 1522-2152.

NAL Call Number: QL1.P52

Abstract: Theory predicts that in long-lived organisms females should invest less energy in reproduction and more in growth and self-maintenance early in life, with this balance shifting as females age and the relative value of each reproductive event increases. We investigated this potential trade-off by characterizing within-population variation in resource allocation to eggs by female painted turtles (*Chrysemys picta*) and relating this variation to their nesting ecology and life history. We examined lipid and protein allocation to yolks, accounting for both relative female age and seasonal effects (first vs. second clutches within a female). Older females appear to increase their investment in reproduction by producing larger eggs, but these eggs are not disproportionately more lipid or protein rich than the smaller eggs from younger females. Within the nesting season, first clutches have more lipid and protein than second clutches. We also found that younger females nest closer to the water than older females. Our results indicate that trade-offs involving resource allocation and nesting behavior do occur both seasonally and with age, suggesting ontogenetic variation in life-history strategies in this long-lived organism.

Descriptors: reptiles, painted turtle, *Chrysemys picta*, nesting behavior, age, season, eggs, resource allocation, impact , reproduction, energy.

Helmick, K.E., M.G. Papich, K.A. Vliet, R.A. Bennett, and E.R. Jacobson (2004). **Pharmacokinetics of enrofloxacin after single-dose oral and intravenous administration in the American alligator (*Alligator mississippiensis*).** *Journal of Zoo and Wildlife Medicine* 35(3): 333-340. ISSN: 1042-7260.

NAL Call Number: SF601.J6

Descriptors: reptiles, American alligator, *Alligator mississippiensis*, enrofloxacin, single dose, intravenous, oral, pharmacokinetics.

Hernandez Franyutti, A., M.C. Uribe Aranzabal, and L.J.J. Guillette (2005). **Oogenesis in the viviparous matrotrophic lizard *Mabuya brachypoda*.** *Journal of Morphology* 265(2): 152-164. ISSN: 0362-2525.

NAL Call Number: 444.8 J826

Descriptors: lizards, physiology, oogonia physiology, vitellogenesis physiology, chromosomes, ultrastructure, cytoplasm physiology, ultrastructure, egg yolk physiology, ultrastructure, anatomy, histology, ovulation physiology.

Hicks, J.W. (2002). **The physiological and evolutionary significance of cardiovascular shunting patterns in reptiles.** *News in Physiological Sciences* 17: 241-245. ISSN: print: 0886-1714; online: 1522-161X.

Abstract: The morphology of the reptilian heart results in the mixing of oxygenated and deoxygenated blood (cardiac shunts). In birds and mammals cardiac shunts are detrimental, but in reptiles this condition is often considered a derived trait, conveying important physiological functions and favored by natural selection. Alternative views are advanced suggesting that, in reptiles, cardiac shunts represent either an ancestral condition or an embryonic trait.

Descriptors: reptiles, cardiovascular physiology, evolution, heart physiology, shunting patterns, significance, heart, blood.

Hidalgo Sanchez, M., J. Francisco Morcillo, J. Navascues, and G. Martin Partido (2007). **Early development of the optic nerve in the turtle *Mauremys leprosa*.** *Brain Research* 1137(1): 35-49. ISSN: 0006-8993.

Descriptors: reptiles, turtle, *Mauremys leprosa* , optic nerve, early development, electron microscopy, optic axons, growth cones, glial cells.

Hochscheid, S., F. Bentivegna, and J.R. Speakman (2003). **The dual function of the lung in chelonian sea turtles: buoyancy control and oxygen storage.** *Journal of Experimental Marine Biology and Ecology* 297(2): 123-140 . ISSN: 0022-0981.

NAL Call Number: QH91.A1J6

Descriptors: reptiles, chelonian sea turtles, lung, dual function, buoyancy control, oxygen storage.

Hoglund, E., W.J. Korzan, M.J. Watt, G.L. Forster, T.R. Summers, H.F. Johannessen, K.J. Renner, and C.H. Summers (2005). **Effects of L-DOPA on aggressive behavior and central monoaminergic activity in the lizard *Anolis carolinensis*, using a new method for drug delivery.** *Behavioural Brain Research* 156(1): 53-64. ISSN: 0166-4328.

Abstract: The dopamine (DA) precursor, L-DOPA (500 microg), was injected into living crickets, which were ingested (one each) by adult male *Anolis carolinensis*. This method of delivery elevated plasma L-DOPA and DA concentrations by approximately 1000-fold. In contrast, plasma epinephrine (Epi) and norepinephrine (NE) were not influenced by L-DOPA treatment, although they were elevated following the consumption of the cricket. Lizards that ingested L-DOPA treated crickets had elevated L-DOPA in all brain regions measured, with DA and/or DOPAC also increased significantly in most brain regions studied. Despite increased DA levels in the striatum and nucleus accumbens as a response to L-DOPA, the treatment had no influence on general motor activity. Central serotonin, NE, and Epi systems were not affected in any brain region by oral L-DOPA treatment. In addition, aggression was inhibited by this dose of L-DOPA, even though there was no effect on serotonergic systems. This is surprising because controlling aggressive behavior is usually considered the province of serotonergic activity. Aggression was measured before and after treatment, and while saline-treated lizards retained the full vigor of aggressive activity, those fed a cricket injected with L-DOPA were only one-third as aggressive after treatment. As L-DOPA treatment did not affect general motor activity, the effect appears to be directly

associated with aggression. This is supported by the observation that L-DOPA treatment delayed latency to eyespot darkening, which predicts the latency to aggression.
Descriptors: lizard, *Anolis carolinensis*, behavior, L-DOPA, agressive behavior, central monoaminergic activity, drug delivery method, crickets, dopamine.

Hong, M.L., L.R. Fu, R.P. Wang, and H.T. Shi (2003). **The advances in the research of the turtle's disease.** *Chinese Journal of Zoology* 38(6): 115-119. ISSN: 0250-3263.
Descriptors: reptiles, turtles, diseases, research, advances, review, cause, diagnosis.
Language of Text: Chinese; Summary in Chinese and English.

Hornby, T.G., J.C. McDonagh, R.M. Reinking, and D.G. Stuart (2002). **Electrophysiological properties of spinal motoneurons in the adult turtle.** *Journal of Comparative Physiology. A, Neuroethology, Sensory, Neural, and Behavioral Physiology* 188(5): 397-408. ISSN: 0340-7594.
NAL Call Number: QP33.J68
Abstract: The purpose of this study was to develop a scheme for classifying turtle motoneurons, such that their properties could be compared to those of other vertebrate species, including, in particular, the cat. A 130-cell sample of turtle motoneurons was provisionally classified into four groups (1-4) on the basis of a cluster analysis of the cells' intracellularly recorded input resistance, rheobase, and slope of their stimulus current-spike frequency relation. These measurements, using sharp microelectrodes and an in vitro spinal cord slice preparation, were particularly robust. It is argued that the cat counterpart of our turtle type 1, 2, and 3 motoneurons innervate slow-twitch muscle fibers, fast-twitch-oxidative fibers, and fast-twitch-glycolytic fibers, respectively. Our turtle type 4 motoneuron is thought analogous to a particularly high-threshold cat and human cell that innervates highly fatigable fast-twitch muscle fibers in both species. Our turtle type 1 category may include cells that innervate non-twitch muscle fibers, which are found in other non-mammalian vertebrates. To advance comparative spinal cord neurobiology, the present results invite comparison to the motoneurons of other vertebrate species, which have yet to be subjected to similar or other classification procedures.
Descriptors: reptiles, adult turtle, classifying spinal motoneurons, electrophysiological properties, cells, cluster analysis.

Huang, X.G. and X.B. Wu (2005). **Immunohistochemical study on gastrointestinal endocrine cells of four reptiles.** *World Journal of Gastroenterology* 11(35): 5498-5505. ISSN: 1007-9327.
Abstract: AIM: To clarify the types, regional distributions and distribution densities as well as morphological features of gastrointestinal (GI) endocrine cells in various parts of the gastrointestinal track (GIT) of four reptiles, *Gekko japonicus*, *Eumeces chinensis*, *Sphenomorphus indicus* and *Eumeces elegans*. METHODS: Paraffin-embedded sections (5 mum) of seven parts (cardia, fundus, pylorus, duodenum, jejunum, ileum, rectum) of GIT dissected from the four reptiles were prepared. GI endocrine cells were revealed by using immunohistochemical techniques of streptavidin-peroxidase (S-P) method. Seven types of antisera against 5-hydroxy-tryptamine (5-HT), somatostatin (SS), gastrin (GAS), glucagon (GLU), substance P (SP), insulin and pancreatic polypeptide were identified and then GI endocrine cells were

photomicrographed and counted. RESULTS: The GI endocrine system of four reptiles was a complex structure containing many endocrine cell types similar in morphology to those found in higher vertebrates. Five types of GI endocrine cells, namely 5-HT, SS, GAS, SP and GLU immunoreactive (IR) cells were identified in the GIT of *G. japonicus*, *E. chinensis* and *S. indicus*; while in the GIT of *E. elegans* only the former three types of endocrine cells were observed. No PP- and INS- IR cells were found in all four reptiles. 5-HT-IR cells, which were most commonly found in the pylorus or duodenum, distributed throughout the whole GIT of four reptiles. However, their distribution patterns varied from each other. SS-IR cells, which were mainly found in the stomach especially in the pylorus and/or fundus, were demonstrated in the whole GIT of *E. chinensis*, only showed restricted distribution in the other three species. GAS-IR cells, with a much restricted distribution, were mainly demonstrated in the pylorus and/or the proximal small intestine of four reptiles. GLU-IR cells exhibited a limited and species-dependent variant distribution in the GIT of four reptiles. SP-IR cells were found throughout the GIT except for jejunum in *E. elegans* and showed a restricted distribution in the GIT of *G. japonicus* and S. indicus. In the GIT of four reptiles the region with the highest degree of cell type heterogeneity was pylorus and most types of GI endocrine cells along the GIT showed the peak density in pylorus as well. CONCLUSION: Some common and unique features of the distribution and morphology of different types of GI endocrine cells are found in four reptiles. This common trait may reflect the similarity in digestive physiology of various vertebrates.

Descriptors: reptiles, *Gekko japonicus*, *Eumeces chinensis*, *Sphenomorphus indicus*, *Eumeces elegans*, immunohistochemical study, gastrointestinal endocrine cells, metabolism, immunohistochemistry, lizards anatomy, histology, lizards metabolism, morphological features, anatomy, histology, digestive physiology.

Irwin, W.P. and K.J. Lohmann (2005). **Disruption of magnetic orientation in hatchling loggerhead sea turtles by pulsed magnetic fields.** *Journal of Comparative Physiology. A, Neuroethology, Sensory, Neural, and Behavioral Physiology* 191(5): 475-480. ISSN: 0340-7594.

NAL Call Number: QP33.J68

Abstract: Loggerhead sea turtles (*Caretta caretta*) derive both directional and positional information from the Earth's magnetic field, but the mechanism underlying magnetic field detection in turtles has not been determined. One hypothesis is that crystals of biogenic, single-domain magnetite provide the physical basis of the magnetic sense. As a first step toward determining if magnetite is involved in sea turtle magnetoreception, hatchling loggerheads were exposed to pulsed magnetic fields (40 mT, 4 ms rise time) capable of altering the magnetic dipole moment of biogenic magnetite crystals. A control group of turtles was treated identically but not exposed to the pulsed fields. Both groups of turtles subsequently oriented toward a light source, implying that the pulsed fields did not disrupt the motivation to swim or the ability to maintain a consistent heading. However, when swimming in darkness under conditions in which turtles normally orient magnetically, control turtles oriented significantly toward the offshore migratory direction while those that were exposed to the magnetic pulses did not. These results are consistent with the hypothesis that at least part of the sea turtle magnetoreception system is based on magnetite. In principle, a magnetite-based magnetoreception system might be involved in detecting directional information, positional

information, or both.
Descriptors: loggerhead sea turtles, *Caretta caretta*, electromagnetic fields, magnetic disruption, orientation, turtle physiology, pulsed magnetic fields.

Jakes, K.A., P.J. O'Donoghue, and J. Whittier (2003). **Ultrastructure of *Hepatozoon boigae* (Mackerras, 1961) nov. comb. from brown tree snakes, *Boiga irregularis*, from northern Australia.** *Parasitology Research* 90(3): 225-231. ISSN: 0932-0113.
NAL Call Number: QL757.P377
Abstract: Intraerythrocytic bodies identified as haemogregarine gamonts were found in 29% of 97 brown tree snakes (*Boiga irregularis*) examined during a haematological survey of reptiles in Australasia during 1994-1998. The morphological characteristics of the parasites were consistent with those of *Haemogregarina boigae* Mackerras, 1961, although the gamonts were slightly larger and lacked red caps but contained distinctive polar grey capsules. Gamonts did not distend host cells but laterally displaced their nuclei. They were contained within parasitophorous vacuoles and possessed typical apicomplexan organelles, including a conoid, polar rings, rhoptries and micronemes. Schizonts producing up to 30 merozoites were detected in endothelial cells of the lungs of 11 snakes. The absence of erythrocytic schizogony suggests the parasites belong to the genus Hepatozoon. Electron microscopy also revealed the presence of curious encapsulated organisms in degenerating erythrocytes. These stages did not possess apical complex organelles and were surrounded by thick walls containing circumferential junctions and interposed strips reminiscent of oocyst sutures.
Descriptors: reptiles, brown tree snakes, *Boiga irregularis*, parasites, coccidiosis, eucoccidiida ultrastructure, erythrocytes ultrastructure, *Hepatozoon boigae* ultrastructure, Australia.

Jessop, T.S., J.M. Sumner, C.J. Limpus, and J.M. Whittier (2004). **Interplay between plasma hormone profiles, sex and body condition in immature hawksbill turtles (*Eretmochelys imbricata*) subjected to a capture stress protocol.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 137(1): 197-204. ISSN: 1095-6433.
Abstract: We investigated plasma hormone profiles of corticosterone and testosterone in immature hawksbill turtles (*Eretmochelys imbricata*) in response to a capture stress protocol. Further, we examined whether sex and body condition were covariates associated with variation in the adrenocortical response of immature turtles. Hawksbill turtles responded to the capture stress protocol by significantly increasing plasma levels of corticosterone over a 5 h period. There was no significant sex difference in the corticosterone stress response of immature turtles. Plasma testosterone profiles, while significantly different between the sexes, did not exhibit a significant change during the 5 h capture stress protocol. An index of body condition was not significantly associated with a turtle's capacity to produce plasma corticosterone both prior to and during exposure to the capture stress protocol. In summary, while immature hawksbill turtles exhibited an adrenocortical response to a capture stress protocol, neither their sex nor body condition was responsible for variation in endocrine responses. This lack of interaction between the adrenocortical response and these internal factors suggests that the inactive reproductive- and the current energetic- status of these immature turtles are important factors that could influence plasma hormone profiles during stress.

Descriptors: reptiles, immature hawksbill turtle, *Eretmochelys imbricata*, capture stress protocol, interplay, plasma hormone profiles, sex and body condition.

Johnson, A.J., A.P. Pessier, and E.R. Jacobson (2007). **Experimental Transmission and Induction of Ranaviral Disease in Western Ornate Box Turtles (*Terrapene ornata ornata*) and Red-Eared Sliders (*Trachemys scripta elegans*).** *Veterinary Pathology* 44(3): 285-297. ISSN: 0300-9858.
Online: http://www.vetpathology.org/cgi/content/abstract/44/3/285
NAL Call Number: 41.8 P27
Abstract: An experimental transmission study was designed to determine whether a causal relationship exists between a Ranavirus (BSTRV) isolated from a Burmese star tortoise that died and the lesions observed in that tortoise. A pilot study was performed with 3 box turtles (*Terrapene ornata ornata*) and 3 red-eared sliders (RESs; *Trachemys scripta elegans*) to assess their suitability in a larger study. Based on the outcome of this study, RESs were selected, and 2 groups of 4 RESs received either an oral (PO) or intramuscular (IM) inoculum containing10(5) 50% Tissue Culture Infecting Dose (TCID(50)) of a BSTRV-infected cell lysate. One turtle each was mock inoculated PO or IM with the same volume of uninfected cell lysate. Three of four IM-inoculated RESs developed clinical signs (nasal and ocular discharge [3 of 3], oral plaques [1 of 3], conjunctivitis and hyphema [1 of 3] and extreme lethargy [3 of 3]). A Ranavirus was isolated from kidney homogenates of 3 euthanatized turtles; DNA sequences of a portion of the major capsid protein gene were amplified by polymerase chain reaction. Consistent histologic lesions were observed only in IM-inoculated turtles and included fibrinoid vasculitis centered on splenic ellipsoids, multifocal hepatic necrosis, and multicentric fibrin thrombi in a variety of locations, including hepatic sinusoids, glomerular capillary loops, and pulmonary capillaries. Virions compatible with Ranavirus were observed within necrotic cells of the spleen of 1 IM-inoculated turtle using transmission electron microscopy. This study fulfills Koch's postulates, confirming a causal relationship between BSTRV and the clinical and histologic changes in chelonians infected with this virus.
Descriptors: reptiles, box turtles, experimental transmission, induction, ranaviral disease, inoculated, PO, IM, clinical signs, Koch's postulates.

Jones, M.S. and M. Ariel (2006). **The effects of unilateral eighth nerve block on fictive VOR in the turtle.** *Brain Research* 1094(1): 149-162. ISSN: 0006-8993.
Abstract: Multiunit activity during horizontal sinusoidal motion was recorded from pairs of oculomotor, trochlear, or abducens nerves of an in vitro turtle brainstem preparation that received inputs from intact semicircular canals. Responses of left oculomotor, right trochlear and right abducens nerves were approximately aligned with leftward head velocity, and that of the respective contralateral nerves were in-phase with rightward velocity. We examined the effect of sectioning or injecting lidocaine (1-2 microL of 0.5%) into the right vestibular nerve. Nerve block caused a striking phase shift in the evoked response of right oculomotor and left trochlear nerves, in which (rightward) control responses were replaced by a smaller-amplitude response to leftward table motion. Such "phase-reversed" responses were poorly defined in abducens nerve recordings. Frequency analysis demonstrated that this activity was advanced in phase relative to post-block responses of the respective contralateral nerves,

which were in turn phase-advanced relative to pre-block controls. Phase differences were largest (approximately 10 degrees) at low frequencies (approximately 0.1 Hz) and statistically absent at 1 Hz. The phase-reversed responses were further investigated by eliminating individual canal input from the left labyrinth following right nVIII block, which indicated that the activation of the vertical canal afferents is the source of this activity.
Descriptors: oculomotor muscles, vestibulo ocular reflex (VOR), semicircular canals, turtles, vestibular nerve, abducens nerve cytology, action potentials, brain stem, denervation, eye movements, functional laterality, head movements, lidocaine, motor neurons physiology, musculoskeletal equilibrium, neural pathways, trochlear nerve.

Kabelik, D., S.L. Weiss, and M.C. Moore (2006). **Steroid hormone mediation of limbic brain plasticity and aggression in free-living tree lizards, *Urosaurus ornatus*.** *Hormones and Behavior* 49(5): 587-597. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Abstract: The neural mechanisms by which steroid hormones regulate aggression are unclear. Although testosterone and its metabolites are involved in both the regulation of aggression and the maintenance of neural morphology, it is unknown whether these changes are functionally related. We addressed the hypothesis that parallel changes in steroid levels and brain volumes are involved in the regulation of adult aggression. We examined the relationships between seasonal hormone changes, aggressive behavior, and the volumes of limbic brain regions in free-living male and female tree lizards (*Urosaurus ornatus*). The brain nuclei that we examined included the lateral septum (LS), preoptic area (POA), amygdala (AMY), and ventromedial hypothalamus (VMH). We showed that the volumes of the POA and AMY in males and the POA in females vary with season. However, reproductive state (and thus hormonal state) was incompletely predictive of these seasonal changes in males and completely unrelated to changes in females. We also detected male-biased dimorphisms in volume of the POA, AMY, and a dorsolateral subnucleus of the VMH but did not detect a dimorphism between alternate male morphological phenotypes. Finally, we showed that circulating testosterone levels were higher in males exhibiting higher frequency and intensity of aggressive display to a conspecific, though brain nucleus volumes were unrelated to behavior. Our findings fail to support our hypothesis and suggest instead that plasma testosterone level covaries with aggression level and in a limited capacity with brain nucleus volumes but that these are largely unrelated relationships.
Descriptors: reptiles, free living tree lizards, *Urosaurus ornatus*, steroid hormonelimbic brain plasticity, aggression, testosterone.
Notes: Comment In: Horm Behav. 2006 May;49(5):577-9.

Katsu, Y., J. Myburgh, S. Kohno, G.E. Swan, L.J.J. Guillette, and T. Iguchi (2006). **Molecular cloning of estrogen receptor alpha of the Nile crocodile.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 143(3): 340-346. ISSN: 1095-6433.
Abstract: Estrogens are essential for normal reproductive activity in female and male vertebrates. In female reptiles, they are essential for ovarian differentiation during a critical developmental stage. To understand the molecular mechanisms of estrogen action in the Nile crocodile (*Crocodylus niloticus*), we have isolated cDNA encoding the estrogen receptor alpha

(ERalpha) from the ovary. Degenerate PCR primers specific to ER were designed and used to amplify Nile crocodile cDNA from the ovary. The full-length Nile crocodile ERalpha cDNA was obtained using 5' and 3' rapid amplification cDNA ends (RACE). The deduced amino acid sequence of the Nile crocodile ERalpha showed high identity to the American alligator ERalpha (98%), caiman ER (98%), lizard ER (82%) and chicken ERalpha (92%), although phylogenetic analysis suggested profound differences in the rate of sequence evolution for vertebrate ER sequences. Expression of ERalpha was observed in the ovary and testis of juvenile Nile crocodiles. These data provide a novel tool allowing future studies examining the regulation and ontogenic expression of ERalpha in crocodiles and expands our knowledge of estrogen receptor evolution.
Descriptors: alligators, amino acid sequence, base sequence, gonads metabolism, molecular sequence data, phylogeny , tertiary protein structure, sequence alignment, Nile crocodile, *Crocodylus niloticus*, molecular cloning, alpha estrogen receptor.

Khalifa, S.A. (2003). **Comparative ultrastructure study on spermiogenesis in two lizards, *Tarentola annularis* and *Agama stellio*.** *Journal of Union of Arab Biologists Cairo A Zoology* 20: 29-40. ISSN: 1110-5372.
Descriptors: reptiles, lizards, *Agama stellio*, *Tarentola annularis*, spermatogenesis, comparative ultrastructure study.
Language of Text: Arabic; English.

Kienzle, E., G. Kopsch, P. Koelle, and M. Clauss (2006). **Chemical composition of turtles and tortoises.** *Journal of Nutrition* 136(7 Suppl): 2053s-2054s. ISSN: 0022-3166.
NAL Call Number: 389.8 J82
Descriptors: reptiles, turtles, tortoises, pets, nutrient requirements, animal feeding, body composition, chemical composition, animal growth, crude protein, ash content, calcium, phosphorus, iron, copper, zinc, liver, turtle shells, tortoise shells.
Notes: Poster presented at the Waltham International Sciences Symposium on "Innovations in Companion Animal Nutrition," September 14 - 18, 2005, Washington, DC.

Knapp, C.R. and A.K. Owens (2005). **An effective new radio transmitter attachment technique for lizards.** *Herpetological Review* 36(3): 264-266. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, lizards, radio telemetry, radio transmitter, attachment technique.

Krohmer, R.W., D. Martinez, and R.T. Mason (2004). **Development of the renal sexual segment in immature snakes: effect of sex steroid hormones.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 139(1): 55-64. ISSN: 1095-6433.
Abstract: The renal sexual segment (RSS) of immature Northern and Diamondback Water Snakes and Red-Sided Garter Snakes exhibited varying responses to testosterone or 17beta-estradiol. In both male and female water snakes, kidney mass was not a reliable indicator of hormone treatment, whereas tubule diameter, epithelial height and number of sexual granules responded to hormone treatment. In male water snakes, either hormone initiated granule development by day 16; by day 23, only testosterone increased granule density.

Female water snakes receiving either hormone exhibited a small number of granules by day 16; by day 23, granules increased only in Diamondback Water Snakes receiving testosterone. Hormones did not initiate RSS hypertrophy in female Red-Sided Garter Snakes. Tubule diameter and epithelial height of testosterone-treated males exhibited significant hypertrophy, while 17beta-estradiol initiated significant increases in tubule diameter. Garter snakes initiated sexual granule development in response to hormone treatment with males exhibiting a greater response than females and testosterone stimulating a greater response than 17beta-estradiol. Sex steroids appear to mimic sexual maturity in immature snakes initiating RSS development. Whereas the RSS of adult males respond to testosterone, our data suggest specific changes in the RSS of females during maturation effectively negates the effect of 17beta-estradiol evident in immature female RSS.
Descriptors: reptiles, immature snakes, renal sexual segment , development, sex steroids, effect.

Kuraku, S., J. Ishijima, C. Nishida Umehara, K. Agata, S. Kuratani, and Y. Matsuda (2006). **cDNA-based gene mapping and GC3 profiling in the soft-shelled turtle suggest a chromosomal size-dependent GC bias shared by sauropsids.** *Chromosome Research* 14(2): 187-202. ISSN: print: 0967-3849; online: 1573-6849.
NAL Call Number: QH600.C47
Abstract: Mammalian and avian genomes comprise several classes of chromosomal segments that vary dramatically in GC-content. Especially in chicken, microchromosomes exhibit a higher GC-content and a higher gene density than macrochromosomes. To understand the evolutionary history of the intra-genome GC heterogeneity in amniotes, it is necessary to examine the equivalence of this GC heterogeneity at the nucleotide level between these animals including reptiles, from which birds diverged. We isolated cDNAs for 39 protein-coding genes from the Chinese soft-shelled turtle, *Pelodiscus sinensis*, and performed chromosome mapping of 31 genes. The GC-content of exonic third positions (GC3) of P. sinensis genes showed a heterogeneous distribution, and exhibited a significant positive correlation with that of chicken and human orthologs, indicating that the last common ancestor of extant amniotes had already established a GC-compartmentalized genomic structure. Furthermore, chromosome mapping in *P. sinensis* revealed that microchromosomes tend to contain more GC-rich genes than GC-poor genes, as in chicken. These results illustrate two modes of genome evolution in amniotes: mammals elaborated the genomic configuration in which GC-rich and GC-poor regions coexist in individual chromosomes, whereas sauropsids (reptiles and birds) refined the chromosomal size-dependent GC compartmentalization in which GC-rich genomic fractions tend to be confined to microchromosomes.
Descriptors: Chinese soft-shelled turtle, *Pelodiscus sinensis*, base composition genetics, chromosome mapping methods, chromosomes, turtles genetics, chickens genetics, cloning, molecular, DNA, complementary genetics, complementary metabolism, evolution, molecular, genome, in situ hybridization, fluorescence, models, biological, phylogeny.

Lee, E.J., D.K. Merwine, L.B. Mann, and N.M. Grzywacz (2005). **Ganglion cell densities in normal and dark-reared turtle retinas.** *Brain Research* 1060(1-2): 40-46. ISSN: 0006-8993.
Abstract: In dark-reared, neonatal turtle retinas, ganglion cell receptive fields and den-

dritic trees grow faster than normal. As a result, their areas may become, on average, up to twice as large as in control retinas. This raises the question of whether the coverage factor of dark-reared ganglion cells is larger than normal. Alternatively, dark rearing may lead to smaller-than-normal cell densities by accelerating apoptosis. To test these alternatives, we investigated the effect of light deprivation on densities and soma sizes of turtle retinal ganglion cells. For this purpose, we marked these cells using retrograde labeling of fixed turtle retinas with DiI (1,1'-dioctadecyl-3,3,3',3'-tetramethylindocarbocyanine perchlorate). Control turtles were maintained in a regular 12-h light/dark cycle from hatching until 4 weeks of age, whereas dark-reared turtles were maintained in total darkness for the same period. Ganglion cells in the control and dark-reared retinas were found to be similar in density and soma sizes. These results show that the mean coverage factor of turtle dark-reared ganglion cells is larger than normal.
Descriptors: turtles, neonatal, retinal ganglion cells, cytology, sensory deprivation, dark-reared, physiology, normal-reared, neonatal, retinas.

Li, M., B.G. Fry, and R.M. Kini (2005). **Eggs-only diet: its implications for the toxin profile changes and ecology of the marbled sea snake (*Aipysurus eydouxii*).** *Journal of Molecular Evolution* 60(1): 81-89. ISSN: print: 0022-2844; online: 1432-1432.
NAL Call Number: QH359.J6
Abstract: Studies so far have correlated the variation in the composition of snake venoms with the target prey population and snake's diet. Here we present the first example of an alternative evolutionary link between venom composition and dietary adaptation of snakes. We describe a dinucleotide deletion in the only three finger toxin gene expressed in the sea snake *Aipysurus eydouxii* (Marbled Sea Snake) venom and how it may have been the result of a significant change in dietary habits. The deletion leads to a frame shift and truncation with an accompanying loss of neurotoxicity. Due to the remarkable streamlining of sea snake venoms, a mutation of a single toxin can have dramatic effects on the whole venom, in this case likely explaining the 50- to 100-fold decrease in venom toxicity in comparison to that of other species in the same genus. This is a secondary result of the adaptation of A. eydouxii to a new dietary habit--feeding exclusively on fish eggs and, thus, the snake no longer using its venom for prey capture. This was parallel to greatly atrophied venom glands and loss of effective fangs. It is interesting to note that a potent venom was not maintained for use in defense, thus reinforcing that the primary use of snake venom is for prey capture.
Descriptors: marbled sea snake, *Aipysurus eydouxii*, diet, eggs only diet, toxin profile changes, venom, prey capture, dietary adaptation, loss of neurotoxicity.

Li, Y., X. Wu, X. Ji, P. Yan, and G. Amato (2007). **The complete mitochondrial genome of salt-water crocodile (*Crocodylus porosus*) and phylogeny of crocodilians**. *Journal of Genetics and Genomics* 34(2): 119-128. ISSN: 1673-8527.
NAL Call Number: QH426
Descriptors: reptiles, crocodile, *Crocodylus porosus*, salt water, mitochindrial genome, complete, phylogeny, nucleotide sequence.

Lin, Y.J. and J.R. Edelman (2005). **Chromocenters and regeneration of teeth in reptiles: a correlation.** *Nucleus Calcutta* 48(3): 171-172. ISSN: 0029-568X.
Descriptors: reptiles, *Iguana iguana*, chromocenters, regeneration of teeth, correlation.

Lin, Z.H. and X. Ji (2005). **Partial tail loss has no severe effects on energy stores and locomotor performance in a lacertid lizard, *Takydromus septentrionalis*.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 175(8): 567-573. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: Many species of lizards use caudal autotomy as a defense strategy to avoid predation, but tail loss entails costs. These topics were studied experimentally in the northern grass lizard, *Takydromus septentrionalis*. We measured lipids in the three-tail segments removed from each of the 20 experimental lizards (adult females) initially having intact tails to evaluate the effect of tail loss on energy stores; we obtained data on locomotor performance (sprint speed, the maximal length traveled without stopping and the number of stops in the racetrack) for these lizards before and after the tail-removing treatments to evaluate the effect of tail loss on locomotor performance. An independent sample of 20 adult females that retained intact tails was measured for locomotor performance to serve as controls for successive measurements taken for the experimental lizards. The lipids stored in the removed tail was positively correlated with tailbase width when holding the tail length constant, indicating that thicker tails contained more lipids than did thinner tails of the same overall length. Most of the lipids stored in the tail were concentrated in the proximal portion of the tail. Locomotor performance was almost unaffected by tail loss until at least more than 71% of the tail (in length) was lost. Our data show that partial tail loss due to predatory encounters or other factors may not severely affect energy stores and locomotor performance in *T. septentrionalis.*
Descriptors: reptiles, lacertid lizard, *Takydromus septentrionalis*, partial tail loss, energy stores, effects, locomotor performance, defense strategy, predation.

Llewelyn, J., R. Shine, and J.K. Webb (2006). **Time of testing affects locomotor performance in nocturnal versus diurnal snakes.** *Journal of Thermal Biology* 31(3): 268-273. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: reptiles, nocturnal snakes, diurnal snakes, locomotor performance, time of testing, affects, time of day.

Lu, Y.A., Y. Wang, A.A. Aguirre, Z.S. Zhao, C.Y. Liu , V.R. Nerurkar, and R. Yanagihara (2003). **RT-PCR detection of the expression of the polymerase gene of a novel reptilian herpesvirus in tumor tissues of green turtles with fibropapilloma.** *Archives of Virology* 148(6): 1155-1163. ISSN: 0304-8608.
NAL Call Number: 448.3 Ar23
Descriptors: reptiles, green turtles, *Chelonia mydas*, papilloma, animal diseases, gene expression, tissue distribution, Herpesviridae, etiology.

Lutterschmidt, D.I. and R.T. Mason (2005). **A serotonin receptor antagonist, but not melatonin, modulates hormonal responses to capture stress in two populations of garter snakes (*Thamnophis sirtalis parietalis* and *Thamnophis sirtalis concinnus*).** *General and Comparative Endocrinology* 141(3): 259-270. ISSN: 0016-6480.

NAL Call Number: 444.8 G28

Abstract: Hormonal and behavioral responses to a stressor depend on many factors, including the influence of other hormones. We examined the role of melatonin in modulating hormonal responses to capture stress in two populations of male garter snakes, *Thamnophis sirtalis*. Studies of red-sided (*T. sirtalis parietalis*) and red-spotted (*T. sirtalis concinnus*) garter snakes were conducted in the field with free-living snakes. Populations of red-sided garter snakes in south-central Manitoba, Canada undergo a period of winter dormancy for approximately 8 months each year followed by an attenuated mating season (4-5 weeks) in early spring. In contrast, the mid-latitude red-spotted garter snake in western Oregon, USA has an extended breeding season and can be active during 10-12 months of the year given appropriate environmental conditions. We chose to study these two populations of garter snakes to investigate possible variation in melatonin function among snakes with different suites of environmental adaptations. To better address these questions, we also examined the effects of 5-hydroxytryptophan (a precursor of melatonin synthesis) and ketanserin (a serotonergic type 2A receptor antagonist) on hormonal responses to capture stress. We observed a trend of increased corticosterone and decreased androgen concentrations in northern-latitude red-sided garter snakes (*T. sirtalis parietalis*) subjected to 4 h of capture stress during the spring. However, these differences were not statistically significant. During the fall, red-sided garter snakes showed no change in corticosterone or androgen concentrations in response to the capture stress treatments. We speculate that northern-latitude red-sided garter snakes suppress hormonal responses to capture stress during preparation for winter dormancy. Treatment with melatonin, 5-hydroxytryptophan, or ketanserin did not significantly influence corticosterone or androgen concentrations of northern-latitude red-sided garter snakes during the spring or fall. Mid-latitude red-spotted garter snakes (*T. sirtalis concinnus*) from Oregon showed a statistically significant increase in corticosterone concentrations in response to 4 h of capture stress; treatment with melatonin, 5-hydroxytryptophan, or ketanserin prior to capture stress had no significant influence on plasma corticosterone concentrations. Androgen concentrations of mid-latitude red-spotted garter snakes in response to capture stress were significantly lower than those of non-stressed control snakes. Neither melatonin nor 5-hydroxytryptophan influenced the change in androgen concentrations during capture stress. However, androgen concentrations of snakes treated with ketanserin prior to 4 h of capture stress did not differ significantly from those of non-stressed control snakes. These studies suggest that melatonin does not modulate hormonal responses to capture stress in this ectothermic model. Our results also suggest that a serotonin-regulated system may play a role in modulating the activity of the hypothalamic-pituitary-gonadal axis during physiological stress responses.

Descriptors: garter snakes, *Thamnophis sirtalis parietalis* and *Thamnophis sirtalis concinnus*, capture stress, serotonin receptor antagonist, melatonin, hormonal response, modulates, stressor, behavioral response.

Lutz, P.L. and S.L. Milton (2004). **Negotiating brain anoxia survival in the turtle.** *Journal of Experimental Biology* 207(Pt 18): 3141-3147. ISSN: 0022-0949.

Online: http://dx.doi.org/10.1242/jeb.01056

NAL Call Number: 442.8 B77

Abstract: The turtle brain's extraordinary ability to tolerate anoxia is based on constitutive and expressed factors. Constitutive factors that predispose for anoxia tolerance include enhanced levels of glycogen stores, increased densities of protective receptors, elevated antioxidant capacities and elevated heat shock protein. However, to survive an anoxic insult, three distinct phases must be negotiated successfully. (1) A coordinated downregulation of ATP demand processes to basal levels. This phase, which takes 1-2 h, includes a reduction in voltage-gated K(+) (Kv) channel transcription and a substantial increase in Hsp72 and Hsc73 levels. During this period, adenosine and K(ATP) channels mediate several key events including channel arrest initiation and a reduction in the release of excitatory amino acids (EAAs). (2) Long-term survival (days) at basal levels of ATP expenditure. Neuronal network integrity is preserved through the continued operation of core activities. These include periodic electrical activity, an increased release of GABA and a continued release of glutamate and dopamine. Adenosine and GABA modulate the glutamate release. There is a further increase in Hsc73, indicating a 'housekeeping' role for this protein during this period. (3) A rapid upregulation of neuronal processes when oxygen becomes available to restore full function, together with the activation of protection mechanisms against reperfusion-generated reactive oxygen species.

Descriptors: reptiles, turtle, anoxia metabolism, brain metabolism, oxygen metabolism, anoxia tolerance, glycogen stores.

Macey, J.R., J.A.I. Schulte, J.J. Fong, I. Das, and T.J. Papenfuss (2006). **The complete mitochondrial genome of an agamid lizard from the Afro-Asian subfamily Agaminae and the phylogenetic position of Bufoniceps and Xenagama.** *Molecular Phylogenetics and Evolution* 39(3): 881-886. ISSN: 1055-7903.

NAL Call Number: QH367.5.M56

Descriptors: reptiles, agamid lizard, complete mitochondrial genome , subfamily, Agaminae, Bufoniceps, Xenagama.

Maginniss, L.A., S.A. Ekelund, and G.R. Ultsch (2004). **Blood oxygen transport in common map turtles during simulated hibernation.** *Physiological and Biochemical Zoology* 77(2): 232-241. ISSN: 1522-2152.

NAL Call Number: QL1.P52

Abstract: We assessed the effects of cold and submergence on blood oxygen transport in common map turtles (*Graptemys geographica*). Winter animals were acclimated for 6-7 wk to one of three conditions at 3 degrees C: air breathing (AB-3 degrees C), normoxic submergence (NS-3 degrees C), and hypoxic (PO2=49 Torr) submergence (HS-3 degrees C). NS-3 degrees C turtles exhibited a respiratory alkalosis (pH 8.07; PCO2=7.9 Torr; [lactate]=2.2 mM) relative to AB-3 degrees C animals (pH 7.89; PCO2=13.4 Torr; [lactate]=1.1 mM). HS-3 degrees C animals experienced a profound metabolic acidosis (pH 7.30; PCO2=7.9 Torr; [lactate]=81 mM). NS-3 degrees C turtles exhibited an increased blood O2 capacity;

however, isoelectric focusing revealed no seasonal changes in the isohemoglobin (isoHb) profile. Blood O2 affinity was significantly increased by cold acclimation; half-saturation pressures (P50's) for air-breathing turtles at 3 degrees and 22 degrees C were 6.5 and 18.8 Torr, respectively. P50's for winter animals submerged in normoxic and hypoxic water were 5.2 and 6.5 Torr, respectively. CO2 Bohr slopes (Delta logP50/Delta pH) were -0.15, -0.16, and -0.07 for AB-3 degrees C, NS-3 degrees C, and HS-3 degrees C turtles, respectively; the corresponding value for AB-22 degrees C was -0.37. The O2 equilibrium curve (O2EC) shape was similar for AB-3 degrees C and NS-3 degrees C turtles; Hill plot n coefficients ranged from 1.8 to 2.0. The O2EC shape for HS-3 degrees C turtles was anomalous, exhibiting high O2 affinity below P50 and a right-shifted segment above half-saturation. We suggest that increases in Hb-O2 affinity and O2 capacity enhance extrapulmonary O2 uptake by turtles overwintering in normoxic water. The anomalous O2EC shape and reduced CO2 Bohr effect of HS-3 degrees C turtles may also promote some aerobic metabolism in hypoxic water.

Descriptors: reptiles, map turtles, blood oxygen transport, simulated hibernation, acclimatization, cold, hypothermia, oxygen blood, metabolism.

Mahmoud, I.Y., J.R. Paulson, M. Dudley, J.S. Patzlaff, and A.Y. Al Kindi (2004). **Secretory proteins in the reproductive tract of the snapping turtle, *Chelhydra serpentina*.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 139(4): 487-494. ISSN: 1095-6433.

Abstract: SDS-polyacrylamide gel electrophoresis was used to separate the secretory proteins produced by the epithelial and endometrial glands of the uterine tube and uterus in the snapping turtle *Chelydra serpentina*. The proteins were analyzed throughout the phases of the reproductive cycle from May to August, including preovulatory, ovulatory, postovulatory or luteal, and vitellogenic phases. The pattern of secretory proteins is quite uniform along the length of the uterine tube, and the same is true of the uterus, but the patterns for uterine tube and uterus are clearly different. We identify 13 major proteins in *C. serpentina* egg albumen. Bands co-migrating with 11 of these are found in the uterine tube, but at most 4 are found in the uterus, suggesting that the majority of the albumen proteins are most likely secreted in the uterine tube, not in the uterus. Although some of the egg albumen proteins are present in the uterine tube only at the time of ovulation, most of the bands corresponding to albumen proteins are present throughout the breeding season even though the snapping turtle is a monoclutch species. These results suggest that the glandular secretory phase in the uterine tube is active and quite homogeneous in function regardless of location or phase of the reproductive cycle.

Descriptors: reptiles, snapping turtle, *Chelydra serpentina*, secretory proteins, reproductive tract, reproductive cycle.

Mallo, K.M., C.A. Harms, G.A. Lewbart, and M.G. Papich (2002). **Pharmacokinetics of fluconazole in loggerhead sea turtles (*Caretta caretta*) after single intravenous and subcutaneous injections, and multiple subcutaneous injections.** *Journal of Zoo and Wildlife Medicine* 33(1): 29-35. ISSN: 1042-7260.

NAL Call Number: SF601.J6

Abstract: Superficial and systemic mycotic infections are common among clinically ill sea turtles, which places growing importance on the establishment of pharmacokinetic-based dosage regimens for antifungal drugs. The pharmacokinetic properties of the antifungal drug fluconazole, after intravenous (i.v.) and subcutaneous (s.c.) injections, were studied in juvenile loggerhead sea turtles (*Caretta caretta*) housed at 23.0-26.5 degrees C. Fluconazole pharmacokinetic properties were further assessed in a multiple-dose s.c. regimen derived from the pharmacokinetic parameters determined in the single-dose study. Pharmacokinetic parameters were calculated, using a two-compartment model, from plasma concentration-time data obtained after single i.v. and s.c. administrations of fluconazole at a dosage of 2.5 mg/ kg body weight in six juvenile sea turtles. Blood samples were collected at intervals through 120 hr after each dose, and the concentration of fluconazole in plasma was measured by reverse-phase high-performance liquid chromatography. The i.v. and s.c. elimination half-lives were 139.5 +/- 36.0 and 132.6 +/- 48.7 hr (mean +/- SD), respectively. Systemic clearance of fluconazole was 8.2 +/- 4.3 ml/kg x hr, and the apparent volume of distribution at steady state was 1.38 +/- 0.29 L/kg. A multiple-dose regimen was derived, which consisted of a loading dose of 21 mg/kg body weight and subsequent doses of 10 mg/kg administered through s.c. injection every 120 hr (5 days). This regimen was administered to four juvenile sea turtles for 10 days, and blood samples were taken to determine peak and trough plasma concentrations of fluconazole. The mean concentrations for the two peak concentrations were 16.9 +/- 1.1 and 19.1 +/- 2.8 microg/ml 4 hr after dosing, and the mean concentrations for the three trough concentrations were 7.2 +/- 2.2, 10.4 +/- 2.7, and 10.7 +/- 2.9 microg/ml 120 hr after dosing. The terminal half-life after the last dose was calculated at 143 hr. Throughout the multiple dosing, fluconazole concentrations remained above approximately 8 microg/ml, a concentration targeted when treating mycotic infections in humans. The results of this study suggest that fluconazole can be effectively administered to sea turtles at a dosage of 10 mg/kg every 5 days after a loading dose of 21 mg/kg.
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, fluconazole, pharmacokinetics, injections, intravenous, subcutaneous, antifungal drugs.

Manley, G.A. (2004). **The lizard basilar papilla and its evolution.** *Springer Handbook of Auditory Research* 22: 200-223. ISSN: 0947-2657.
Descriptors: reptiles, lizard, basilar papilla, evolution, auditory research.

Marcu Lapadat, M. (2001). **Catecolaminele si functia tiroidiana la reptile. II. Actiunea noradrenalinei (iarna). [Catecholamines and thyroid function in reptiles. II. Effects of noradrenaline administration (cold season)].** *Analele Universitatii Bucuresti Biologie* 50: 91-97. ISSN: 0378-8989.
Descriptors: reptiles, catecholamines, thyroid function, noradrenaline administration, effects.
Language of Text: Romanian; Summary in English and Romanian.

Martin, J., N. Kogo, T.X. Fan, and M. Ariel (2003). **Morphology of the turtle accessory optic system**. *Visual Neuroscience* 20(6): 639-649. ISSN: 0952-5238.
Online: http://dx.doi.org/10.1017/S0952523803206064
Descriptors: reptiles, turtle, accessory optic system, morphology, eyes.

Martinez Marcos, A., I. Ubeda Banon, E. Lanuza, and M. Halpern (2005). **Chemoarchitecture and afferent connections of the "olfactostriatum": a specialized vomeronasal structure within the basal ganglia of snakes.** *Journal of Chemical Neuroanatomy* 29(1): 49-69. ISSN: 0891-0618.
Abstract: The olfactostriatum, a portion of the striatal complex of snakes, is the major tertiary vomeronasal structure in the ophidian brain, receiving substantial afferents from the nucleus sphericus, the primary target of accessory olfactory bulb efferents. In the present study, we have characterized the olfactostriatum of garter snakes (*Thamnophis sirtalis*) on the basis of chemoarchitecture (distribution of serotonin, neuropeptide Y and tyrosine hydroxylase) and hodology (afferent connections). The olfactostriatum is densely immunoreactive for serotonin and neuropeptide Y and shows moderate-to-weak immunoreactivity for tyrosine hydroxylase. In addition to afferents from the nucleus sphericus, the olfactostriatum receives inputs from the dorsal and lateral cortices, nucleus of the accessory olfactory tract, external and dorsolateral amygdalae, dorsomedial thalamic nucleus, ventral tegmental area and raphe nuclei. Double labeling experiments demonstrated that the distribution of serotonin and neuropeptide Y in this area almost completely overlaps the terminal field of projections from the nucleus sphericus. Also, serotonergic and dopaminergic innervation of the olfactostriatum likely arise, respectively, from the raphe nuclei and the ventral tegmental area, whereas local circuit neurons originate the neuropeptide Y immunoreactivity. These results indicate that the olfactostriatum of snakes could be a portion of the nucleus accumbens, with features characteristic of the accumbens shell, devoted to processing vomeronasal information. Comparative data suggest that a similar structure is present in the ventral striatum of amphibians and mammals.
Descriptors: reptiles, garter snake, *Thamnophis sirtalis*, olfactostriatum, chemoarchitecture, afferent connections, vermeronasalstructure, ganglia.

Masunaga, G. and H. Ota (2003). **Growth and reproduction of the sea snake, *Emydocephalus ijimae*, in the central Ryukyus, Japan: a mark and recapture study.** *Zoological Science* 20(4): 461-470. ISSN: 0289-0003.
NAL Call Number: QL1.Z68
Abstract: A mark and recapture study was carried out for three years on a population of the Ijima's sea snake, *Emydocephalus ijimae*, in the coastal shallow water of Zamamijima Island, central Ryukyus, Japan. The relatively high recapture (47% of 167 marked snakes) suggests that *E. ijimae* is a particularly philopatric, sedentary species among the sea snakes. The sex ratio (male: female), approximately 1.6:1, significantly skewed from 1:1. The growth rate in SVL declined with growth, with females thoroughly growing better than males. Males and females were estimated to begin reproductive activity in the second or third summer and the third spring after birth, respectively. Frequency of female reproduction is guessed to vary from annual to biennial, or even less frequent.

Descriptors: reptiles, sea snake, *Emydocephalus ijimae*, growth, reproduction, recapture study, Japan.

Maxwell, L.K. and E.R. Jacobson (2004). **Allometric scaling of kidney function in green iguanas *Iguana iguana*.** *Comparative Biochemistry and Physiology Part A, Molecular and Integrative Physiology* 138(3): 383-390. ISSN: 1095-6433.
Descriptors: reptiles, green iguanas, *Iguana iguana*, kidney function, allometric scaling, renal scintigraphy, diagnostic tool, glomerular filtration rate.

Mehta, V. and E. Sernagor (2006). **Early neural activity and dendritic growth in turtle retinal ganglion cells.** *European Journal of Neuroscience.* 24(3): 773-786. ISSN: print: 0953-816X; online: 1460-9568.
Abstract: Early neural activity, both prenatal spontaneous bursts and early visual experience, is believed to be important for dendritic proliferation and for the maturation of neural circuitry in the developing retina. In this study, we have investigated the possible role of early neural activity in shaping developing turtle retinal ganglion cell (RGC) dendritic arbors. RGCs were back-labelled from the optic nerve with horseradish peroxidase (HRP). Changes in dendritic growth patterns were examined across development and following chronic blockade or modification of spontaneous activity and/or visual experience. Dendrites reach peak proliferation at embryonic stage 25 (S25, one week before hatching), followed by pruning in large field RGCs around the time of hatching. When spontaneous activity is chronically blocked in vivo from early embryonic stages (S22) with curare, a cholinergic nicotinic antagonist, RGC dendritic growth is inhibited. On the other hand, enhancement of spontaneous activity by dark-rearing (Sernagor & Grzywacz (1996)Curr. Biol., 6, 1503-1508) promotes dendritic proliferation in large-field RGCs, an effect that is counteracted by exposure to curare from hatching. We also recorded spontaneous activity from individual RGCs labelled with lucifer yellow (LY). We found a tendency of RGCs with large dendritic fields to be spontaneously more active than small-field cells. From all these observations, we conclude that immature spontaneous activity promotes dendritic growth in developing RGCs.
Descriptors: turtles, action potentials physiology, cell differentiation physiology, dendrites physiology, retina embryology, retina growth and development, retinal ganglion cells physiology, action potentials drug effects, aging physiology, cell differentiation drug effects, cell shape physiology, darkness, dendrites drug effects, dendrites ultrastructure, horseradish peroxidase, isoquinolines, nicotinic antagonists pharmacology, patch clamp techniques, retina cytology, retinal ganglion cells cytology, retinal ganglion cells drug effects, sensory deprivation physiology, synaptic transmission physiology, visual pathways cytology, visual pathways embryology, visual pathways growth and development.

Mehta, V. and E. Sernagor (2006). **Receptive field structure-function correlates in developing turtle retinal ganglion cells.** *European Journal of Neuroscience.* 24(3): 787-794. ISSN: print:0953-816X; online: 1460-9568.
Abstract: Mature retinal ganglion cells (RGCs) have distinct morphologies that often reflect specialized functional properties such as On and Off responses. But the structural correlates of many complex receptive field (RF) properties (e.g. responses to motion) remain to be deci-

phered. In this study, we have investigated whether motion anisotropies (non-homogeneities) characteristic of embryonic turtle RGCs arise from immature dendritic arborization in these cells. To test this hypothesis, we have looked at structure-function correlates of developing turtle RGCs from Stage 23 (S23) when light responses emerge, until 15 weeks post-hatching (PH). Using whole cell patch clamp recordings, RGCs were labelled with Lucifer Yellow (LY) while recording their responses to moving edges of light. Comparison of RF and dendritic arbor layouts revealed a weak correlation. To obtain a larger structural sample of developing RGCs, we have looked at dendritic morphology in RGCs retrogradely filled with the tracer horseradish peroxidase (HRP) from S22 (when RGCs become spontaneously active, shortly before they become sensitive to light) until two weeks PH. We found that there was intense dendritic growth from S22 onwards, reaching peak proliferation at S25 (a week before hatching), while RGCs are still exhibiting significant motion anisotropies. Based on these observations, we suggest that immature anisotropic RGC RFs must originate from sparse synaptic inputs onto RGCs rather than from the immaturity of their growing dendritic trees.
Descriptors: turtles, retina embryology, growth, development, retinal ganglion cells, physiology, vision physiology, visual fields, aging physiology, cell differentiation, cell shape, dendrites ultrastructure, motion perception, neural pathways, cytology, embryology, growth, development , photic stimulation, retina cytology, retinal ganglion cells, cytology, synapses physiology.

Melo, M.B., S. Bordin, A.S.S. Duarte, S.H. Ogo, M.A. Torsoni, S.T.O. Saad, and F.F. Costa (2003). **Molecular characterization of hemoglobin alpha-D chains from *Geochelone carbonaria* and *Geochelone denticulata* land turtles.** *Comparative Biochemistry and Physiology Part B Biochemistry and Molecular Biology* 134(2): 389-395. ISSN: 1096-4959.
Abstract: In order to help elucidate the evolution of alpha-globins, the complete cDNA and amino acid sequences of *Geochelone carbonaria* and *Geochelone denticulata* land turtles alpha-D chains have been described. In *G. carbonaria*, the cDNA is 539 bp with ATG start codon located at position 46, TGA stop codon at position 469 and AATAAA polyadenylation signal at position 520. In *G. denticulata*, the cDNA is 536 bp with ATG start codon located at position 46, TGA stop codon at position 469 and AATAAA polyadenylation signal at position 517. Both cDNAs codify 141 amino acid residues, differing from each other in only four amino acid residues. When comparing with human Hb alpha-chain, alterations in important regions can be noted: alpha110 Ala-Gly, alpha114 Pro-Gly, alpha117 Phe-Tyr and alpha122 His-Gln. There is a high homology between the amino acids of these turtles when compared with chicken alpha-D chains, progressively decreasing when compared with human, crocodile, snake, frog and fish alpha-chains. Phylogenetic analysis of alpha-D chains shows that those of turtles are closer to those of birds than to snakes and lizards.
Descriptors: reptiles, land turtles, *Geochelone carbonatia*, *Geochelone denticulata*, cDNA, amino acid sequences, birds , snakes, lizards, crocodiles.

Merchant, M. and A. Britton (2006). **Characterization of serum complement activity of saltwater (*Crocodylus porosus*) and freshwater (*Crocodylus johnstoni*) crocodiles.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 143(4): 488-493. ISSN: 1095-6433.

Abstract: We employed a spectroscopic assay, based on the hemolysis of sheep red blood cells (SRBCs), to assess the innate immune function of saltwater and freshwater crocodiles in vitro. Incubation of serum from freshwater and saltwater crocodiles with SRBCs resulted in concentration-dependent increases in SRBC hemolysis. The hemolytic activity occurred rapidly, with detectable activity within 2 min and maximum activity at 20 min. These activities, in both crocodilian species, were heat sensitive, unaffected by 20 mM methylamine, and completely inhibited by low concentrations of EDTA, suggesting that the alternative serum complement cascade is responsible for the observed effects. The hemolytic activities of the sera were inhibited by other chelators of divalent metal ions, such as phosphate and citrate. The inhibition of SRBC hemolysis by EDTA could be completely restored by the addition of 10 mM Ca2+ or Mg2+, but not Ba2+, Cu2+ or Fe2+, indicating specificity for these metal ions. The serum complement activities of both crocodilians were temperature-dependent, with peak activities occurring at 25-30 degrees C and reduced activities below 25 degrees C and above 35 degrees C.
Descriptors: reptiles, saltwater (*Crocodylus porosus*) and freshwater (*Crocodylus johnstoni*) crocodiles, crocodiles blood, complement system proteins metabolism, barium pharmacology, calcium pharmacology, copper pharmacology, edetic acid pharmacology, erythrocytes metabolism, fresh water, hemolysis drug effects, iron pharmacology, kinetics, magnesium pharmacology, temperature.

Merchant, M.E., C. Roche, R.M. Elsey, and J. Prudhomme (2003). **Antibacterial properties of serum from the American alligator (*Alligator mississippiensis*)**. *Comparative Biochemistry and Physiology Part B, Biochemistry and Molecular Biology* 136(3): 505-513. ISSN: 1096-4959.
Descriptors: reptiles, American alligator, *Alligator mississippiensis*, antibacterial properties, blood, serum, *E. coli*, serum complement system.

Merchant, M.E., C.M. Roche, D. Thibodeaux, and R.M. Elsey (2005). **Identification of alternative pathway serum complement activity in the blood of the American alligator (*Alligator mississippiensis*).** *Comparative Biochemistry and Physiology Part B Biochemistry and Molecular Biology* 141(3): 281-288. ISSN: 1096-4959.
Descriptors: reptiles, American alligator, *Alligator mississippiensis*, serum complement activity, blood, identification of alternative pathway.

Metz, M., A.M. Piliponsky, C.C. Chen, V. Lammel, M. eAbrink, G. Pejler, M. Tsai, and S.J. Galli (2006). **Mast cells can enhance resistance to snake and honeybee venoms.** *Science* 313(5786): 526-530. ISSN: 0036-8075.
Abstract: Snake or honeybee envenomation can cause substantial morbidity and mortality, and it has been proposed that the activation of mast cells by snake or insect venoms can contribute to these effects. We show, in contrast, that mast cells can significantly reduce snake-venom-induced pathology in mice, at least in part by releasing carboxypeptidase A and possibly other proteases, which can degrade venom components. Mast cells also significantly reduced the morbidity and mortality induced by honeybee venom. These findings identify a new biological function for mast cells in enhancing resistance to the morbidity and mortality

induced by animal venoms.
Descriptors: reptiles, snake, venoms, honeybee, resistance, mast cells, enhance, reduce snake venom pathology, bee morbidity, mortality.

Miller, H.C. (2006). **Cloacal and buccal swabs are a reliable source of DNA for microsatellite genotyping of reptiles**. *Conservation Genetics* 7(6): 1001-1003. ISSN: 1566-0621.
Descriptors: reptiles, DNA, microsatellite genotyping, cloacal, buccal, swabs, DNA sampling, blood sampling.

Milton, S.L., G. Nayak, P.L. Lutz, and H.M. Prentice (2006). **Gene transcription of neuroglobin is upregulated by hypoxia and anoxia in the brain of the anoxia-tolerant turtle *Trachemys scripta*.** *Journal of Biomedical Science* 13(4): 509-514. ISSN: print: 1021-7770; online: 1423-0127.
NAL Call Number: R850.A1
Abstract: Neuroglobin is a heme protein expressed in the vertebrate brain in mammals, fishes, and birds. The physiological role of neuroglobin is not completely understood but possibilities include serving as an intracellular oxygen-carrier or oxygen-sensor, as a terminal oxidase to regenerate NAD(+) under anaerobic conditions, or involvement in NO or ROS metabolism. As the vertebrate nervous system is particularly sensitive to hypoxia, an intracellular protein that helps sustain cellular respiration would aid hypoxic survival. However, the regulation of Neuroglobin (Ngb) under conditions of varying oxygen is controversial. This study examines the regulation of Ngb in an anoxia-tolerant vertebrate under conditions of hypoxia and anoxia. The freshwater turtle *Trachemys scripta* can withstand complete anoxia for days, and adaptations that permit neuronal survival have been extensively examined. Turtle neuroglobin specific primers were employed in RT-PCR for determining the regulation of neuroglobin mRNA expression in turtles placed in normoxia, hypoxia (4 h), anoxia (1 and 4 h), and anoxia-reoxygenation. Whole brain expression of neuroglobin is strongly upregulated by hypoxia and post-anoxic-reoxygenation in *T. scripta*, with a lesser degree of upregulation at 1 and 4 h anoxia. Our data implicate neuroglobin in mediating brain anoxic survival.
Descriptors: anorexia tolerant turtle, *Trachemys scripta*, gene expression and regulation, hypoxia, nerve tissue proteins, neuroglobin, heme proteins, turtle genetics.

Miranda Anaya, M., P.A. Bartell, and M. Menaker (2002). **Circadian rhythm of iguana electroretinogram: the role of dopamine and melatonin.** *Journal of Biological Rhythms* 17(6): 526-538. ISSN: print: 0748-7304; online: 1522-4531.
Abstract: The amplitude of the b-wave of the electroretinogram (ERG) varies with a circadian rhythm in the green iguana; the amplitude is high during the day(or subjective day) and low during the night (or subjective night). Dopamine and melatonin contents in the eye are robustly rhythmic under constant conditions; dopamine levels are high during the subjective day, and melatonin levels are high during the subjective night. Dopamine and melatonin affect the amplitude of the b-wave in an antagonistic and phase-dependent manner: dopamine D2-receptor agonists injected intraocularly during the subjective night produce high-amplitude b-waves characteristic of the subjective day, whereas melatonin injected

intraocularly during the subjective day reduces b-wave amplitude. Sectioning the optic nerve abolishes the circadian rhythms of b-wave amplitude and of dopamine content. The results of this study suggest that in iguana, a negative feedback loop involving dopamine and melatonin regulates the circadian rhythm of the ERG b-wave amplitude that is at least in part generated in the brain.
Descriptors: reptiles, green iguana, circadian rhythm, electroretinogram, dopamine, melatonin, role, day, night, eye, B-wave.

Moco, T.C., L.H. O'Dwyer, F.C. Vilela, T.H. Barrella, and R.J. da Silva (2002). **Morphologic and morphometric analysis of *Hepatozoon* spp. (Apicomplexa, Hepatozoidae) of snakes.** *Memorias Do Instituto Oswaldo Cruz* 97(8): 1169-1176. ISSN: 1678-8060.
Online: http://dx.doi.org/10.1590/S0074-02762002000800019
Abstract: *Hepatozoon* species are the most abundant hemoparasites of snakes. Its identification has been based mainly on the morphologic characterization of the gamonts in the peripheral blood of the vertebrate host and also of the cysts found in the internal organs of the vertebrate and invertebrate hosts. Using a computerized image analysis system, we studied five species of *Hepatozoon* from recently captured snakes in Botucatu, State of S o Paulo, Brazil, to evaluate the importance of the morphology and morphometry of the gamonts for the characterization of *Hepatozoon* species and to analyze the morphologic changes induced in the erythrocytes by the parasite. The studied species were *H. terzii* of *Boa constrictor amarali*, *Hepatozoon* sp. of *Crotalus durissusterrificus*, *H. philodryasi* of *Philodryas patagoniensis*, and *H. migonei* and *H. cyclagrasi* of *Hydrodynastes gigas*. We observed three different groups, one of them including the species *H. terzii, H. philodryasi* and *Hepatozoon* sp. of *C. durissus terrificus*; and the other two consisting of *H. migonei* and *H. cyclagrasi*. Degree of alterations in the erythrocytes was variable and it may be useful for characterization of *Hepatozoon* species.
Descriptors: reptiles, snakes, parasites, *Hepatozoon*, species peripheral blood, gamonts computerized image analysis, characterization, Brazil.

Mubarak, M. (2006). **Ultrastructure of sperm tail differentiation of the lizard *Stenodactylus dorie* (Squamata, Reptilia).** *Journal of Biological Sciences* 6(1): 187-192. ISSN: 1727-3048.
Online: http://ansijournals.com/3/detail.php?id=1&jid=jbs&theme=3&issueno=165&articleno=55270
NAL Call Number: QH301.J687
Descriptors: reptiles, lizard, *Stenodactylus dorie*, sperm tail differentiation, ultrastructural study.

Nakata, F., K. Kuroyanagi, N. Kamezaki, and T. Amakawa (2006). **An electrophysiological study on the sea turtle vision**. *Comparative Biochemistry and Physiology Part B Biochemistry and Molecular Biology* 145(3-4): 422. ISSN: 1096-4959.
Descriptors: reptiles, sea turtle, vision, electrophysiological study, meeting.
Notes: Meeting Information: 28th Annual Meeting of the Japanese Society for Comparative Physiology and Biochemistry, Hamamatsu, Japan; July 27 -29, 2006.

Nikitina, N.G. and N.B. Ananjeva (2005). **The skin sense organs of lizards of *Teratoscincus* genus (Squamata: Sauria: Gekkonidae).** *Russian Journal of Herpetology* 12(Suppl.): 291-295 . ISSN: 1026-2296.
Descriptors: reptiles, lizards, skin sense organs, genus *Teratoscincus*.

Nitto, T., C. Lin, K.D. Dyer, R.A. Wagner, and H.F. Rosenberg (2005). **Characterization of a ribonuclease gene and encoded protein from the reptile, *Iguana iguana*.** *Gene* 352: 36-44. ISSN: 0378-1119.
Abstract: In this work we identify an intronless open reading frame encoding an RNase A ribonuclease from genomic DNA from the *Iguana iguana* IgH2 cell line. The iguana RNase is expressed primarily in pancreas, and represents the majority of the specific enzymatic activity in this tissue. The encoded sequence shares many features with its better-known mammalian counterparts including the crucial His12, Lys40 and His114 catalytic residues and efficient hydrolytic activity against yeast tRNA substrate (k(cat)/K(m)=6 x 10(4) M(-1) s(-1)), albeit at a reduced pH optimum (pH 6.0). Although the catalytic activity of the iguana RNase is not diminished by human placental RI, iguana RNase is not bactericidal nor is it cytotoxic even at micromolar concentrations. Phylogenetic analysis indicates moderate (46%) amino acid sequence similarity to a pancreatic RNase isolated from *Chelydra serpentina* (snapping turtle) although no specific relationship could be determined between these RNases and the pancreatic ribonucleases characterized among mammalian species. Further analysis of ribonucleases from non-mammalian vertebrate species is needed in order to define relationships and lineages within the larger RNase A gene superfamily.
Descriptors: reptiles, iguana, *Iguana iguana*, ribonuclease gene, characterization, encoded protein, RNase, DNA, snapping turtle.

Oros, J., P. Calabuig, and S. Deniz (2004). **Digestive pathology of sea turtles stranded in the Canary Islands between 1993 and 2001.** *Veterinary Record* 155(6): 169-174. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, sea turtles, lesions (animal), digestive system, diseases, pathology, stranded, Canary Islands.

Overgaard, J., H. Gesser, and T. Wang (2007). **Tribute to P. L. Lutz: Cardiac performance and cardiovascular regulation during anoxia/hypoxia in freshwater turtles.** *Journal of Experimental Biology* 210(Pt 10): 1687-1699. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.001925
NAL Call Number: 442.8 B77
Abstract: Freshwater turtles overwintering in ice-covered ponds in North America may be exposed to prolonged anoxia, and survive this hostile environment by metabolic depression. Here, we review their cardiovascular function and regulation, with particular emphasis on the factors limiting cardiac performance. The pronounced anoxia tolerance of the turtle heart is based on the ability to match energy consumption with the low anaerobic ATP production during anoxia. Together with a well-developed temporal and spatial energy buffering by creatine kinase, this allows for cellular energy charge to remain high during anoxia. Further-

more, the turtle heart is well adapted to handle the adverse effects of free phosphate arising when phosphocreatine stores are used. Anoxia causes tenfold reductions in heart rate and blood flows that match the metabolic depression, and blood pressure is largely maintained through increased systemic vascular resistance. Depression of the heart rate is not driven by the autonomic nervous system and seems to arise from direct effects of oxygen lack and the associated hyperkalaemia and acidosis on the cardiac pacemaker. These intra- and extracellular changes also affect cardiac contractility, and both acidosis and hyperkalaemia severely depress cardiac contractility. However, increased levels of adrenaline and calcium may, at least partially, salvage cardiac function under prolonged periods of anoxia.
Descriptors: reptiles, freshwater turtles, cardiac performance, cardiovascular regulation, anoxia, hypoxia, heart, blood flow.

Overgaard, J. and T. Wang (2002). **Increased blood oxygen affinity during digestion in the snake *Python molurus*.** *Journal of Experimental Biology* 205(Pt 21): 3327-3334. ISSN: 0022-0949.
NAL Call Number: 442.8 B77
Abstract: Many snakes exhibit large increases in metabolic rate during digestion that place extensive demands on efficient oxygen transport. In the present study, we describe blood oxygen affinity following three weeks of fasting and 48 h after feeding in the Burmese python (*Python molurus*). We also report simultaneous measurements of arterial blood gases and haematological parameters. Arterial blood was obtained from chronically implanted catheters, and blood oxygen-dissociation curves were constructed from oxygen content measurements at known oxygen partial pressure (P(O(2))) values at 2% and 5% CO(2). Arterial pH remained constant at approximately 7.6 after feeding, but digestion was associated with an approximately 6 mmol l(-1) increase in [HCO(3)(-)], while CO(2) partial pressure (P(CO(2))) increased from 2.21+/-0.13 kPa in fasted animals to 2.89+/-0.17 kPa at 48 h after feeding. Blood oxygen affinity in vivo was predicted on the basis of pH in vivo and the blood oxygen-dissociation curves obtained in vitro. The blood oxygen affinity in vivo increased during digestion, with P(50) values decreasing from 4.58+/-0.11 kPa to 3.53+/-0.24 kPa. This increase was associated with a significant decrease in the red blood cell [NTP]/[Hb(4)] ratio (relationship between the concentrations of organic phosphates and total haemoglobin) and a significant decrease in mean cellular haemoglobin content, which is indicative of swelling of the red blood cells. Our data for blood oxygen affinity and arterial oxygen levels, together with previously published values of oxygen uptake and blood flows, allow for a quantitative evaluation of oxygen transport during digestion. This analysis shows that a large part of the increased metabolism during digestion is supported by an increased venous extraction, while arterial P(O(2)) (Pa(O(2))) and haemoglobin saturation do not vary with digestive status. Thus, we predict that venous P(O(2)) (Pv(O(2))) is reduced from a fasting value of 5.2 kPa to 1.6 kPa during digestion.
Descriptors: reptiles, snakes, *Python molurus*, digestion, increased blood oxygen, metabolic rate, increase, arterial blood gases, hematological parameters.

Pamenter, M.E., M.D. Richards, and L.T. Buck (2007). **Anoxia-induced changes in reactive oxygen species and cyclic nucleotides in the painted turtle.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 177(4): 473-481. ISSN: print: 0174-

1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: The Western painted turtle survives months without oxygen. A key adaptation is a coordinated reduction of cellular ATP production and utilization that may be signaled by changes in the concentrations of reactive oxygen species (ROS) and cyclic nucleotides (cAMP and cGMP). Little is known about the involvement of cyclic nucleotides in the turtle's metabolic arrest and ROS have not been previously measured in any facultative anaerobes. The present study was designed to measure changes in these second messengers in the anoxic turtle. ROS were measured in isolated turtle brain sheets during a 40-min normoxic to anoxic transition. Changes in cAMP and cGMP were determined in turtle brain, pectoralis muscle, heart and liver throughout 4 h of forced submergence at 20-22 degrees C. Turtle brain ROS production decreased 25% within 10 min of cyanide or N(2)-induced anoxia and returned to control levels upon reoxygenation. Inhibition of electron transfer from ubiquinol to complex III caused a smaller decrease in [ROS]. Conversely, inhibition of complex I increased [ROS] 15% above controls. In brain [cAMP] decreased 63%. In liver [cAMP] doubled after 2 h of anoxia before returning to control levels with prolonged anoxia. Conversely, skeletal muscle and heart [cAMP] remained unchanged; however, skeletal muscle [cGMP] became elevated sixfold after 4 h of submergence. In liver and heart [cGMP] rose 41 and 127%, respectively, after 2 h of anoxia. Brain [cGMP] did not change significantly during 4 h of submergence. We conclude that turtle brain ROS production occurs primarily between mitochondrial complexes I and III and decreases during anoxia. Also, cyclic nucleotide concentrations change in a manner suggestive of a role in metabolic suppression in the brain and a role in increasing liver glycogenolysis.
Descriptors: reptiles, anoxic induced changes, western painted turtle, cyclic nucleotides, reactive oxygen species, ATP production, brain.

Paolucci, M., S. Buono, R. Sciarrillo, and R. Putti (2006). **Effects of leptin administration on the endocrine pancreas and liver in the lizard *Podarcis sicula*.** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 305(5): 383-395. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Abstract: In this study, we investigated the presence of leptin receptor in pancreatic islets and the effect of exogenous leptin administration in *Podarcis sicula* on glucose metabolism. Our data show the presence of leptin receptor immunoreactivity in the endocrine pancreas suggesting that leptin may act at a peripheral level as previously postulated in mammals. The effects of short- and long-term and dose-response treatment with supraphysiological concentrations of leptin on circulating levels of insulin, glucagon and glucose in the blood have been evaluated. Taken together, our results indicate that leptin treatment was followed by an increase in insulin, glucagon and glucose in the blood, depending on the dose of leptin. Moreover, leptin treatment brought about a decrease of glycogen and the appearance of tyrosine-phosphorylated proteins in the liver. This study shows that in the lizard *P. sicula* leptin is involved in glucose metabolism.
Descriptors: lizard, *Podarcis sicula*, islets of Langerhans drug effects, leptin pharmacology, liver drug effects, lizards physiology, blood glucose, dose response relationship, drug, electro-

phoresis, polyacrylamide gel, glucagon blood, immunohistochemistry, insulin blood, islets of langerhans metabolism, liver metabolism, liver extracts analysis, mice, receptors, cell surface metabolism.

Parham, J.F., C.R. Feldman, and J.L. Boore (2006). **The complete mitochondrial genome of the enigmatic bigheaded turtle (*Platysternon*): Description of unusual genomic features and the reconciliation of phylogenetic hypotheses based on mitochondrial and nuclear DNA.** *BMC Evolutionary Biology* 6: 11. ISSN: 1471-2149.
Online: http://dx.doi.org/10.1186/1471-2148-6-11
Abstract: BACKGROUND: The big-headed turtle (*Platysternon megacephalum*) from east Asia is the sole living representative of a poorly-studied turtle lineage (Platysternidae). It has no close living relatives, and its phylogenetic position within turtles is one of the outstanding controversies in turtle systematics. *Platysternon* was traditionally considered to be close to snapping turtles (Chelydridae) based on some studies of its morphology and mitochondrial (mt) DNA, however, other studies of morphology and nuclear (nu) DNA do not support that hypothesis. RESULTS: We sequenced the complete mt genome of *Platysternon* and the nearly complete mt genomes of two other relevant turtles and compared them to turtle mt genomes from the literature to form the largest molecular dataset used to date to address this issue. The resulting phylogeny robustly rejects the placement of *Platysternon* with Chelydridae, but instead shows that it is a member of the Testudinoidea, a diverse, nearly globally-distributed group that includes pond turtles and tortoises. We also discovered that *Platysternon* mtDNA has large-scale gene rearrangements and possesses two, nearly identical, control regions, features that distinguish it from all other studied turtles. CONCLUSION: Our study robustly determines the phylogenetic placement of *Platysternon* and provides a well-resolved outline of major turtle lineages, while demonstrating the significantly greater resolving power of comparing large amounts of mt sequence over that of short fragments. Earlier phylogenies placing *Platysternon* with chelydrids required a temporal gap in the fossil record that is now unnecessary. The duplicated control regions and gene rearrangements of the *Platysternon* mtDNA probably resulted from the duplication of part of the genome and then the subsequent loss of redundant genes. Although it is possible that having two control regions may provide some advantage, explaining why the control regions would be maintained while some of the duplicated genes were eroded, examples of this are rare. So far, duplicated control regions have been reported for mt genomes from just 12 clades of metazoans, including *Platysternon*.
Descriptors: turtle, DNA, mitochondrial chemistry, genes, mitochondrial, mitochondria genetics, phylogeny, turtles classification, cell nucleus genetics, DNA chemistry, gene order, genome, genomics, models, genetic, turtles anatomy and histology, turtles genetics.

Pasqualetti, M., C. Bertolucci, M. Ori, A. Innocenti, M.C. Magnone, W.J. De Grip, I. Nardi, and A. Foa (2003). **Identification of circadian brain photoreceptors mediating photic entrainment of behavioural rhythms in lizards.** *European Journal of Neuroscience* 18(2): 364-372 . ISSN: print:0953-816X; online: 1460-9568.
Abstract: We have shown previously that in ruin lizards (*Podarcis sicula*) the ablation of all known photoreceptive structures (lateral eyes, pineal and parietal eye) in the same indi-

vidual animal does not prevent entrainment of their circadian locomotor rhythms to light. The present study was aimed at identifying the circadian brain photoreceptors mediating entrainment. For this purpose, we looked for opsin expression in the brain by means of immunocytochemistry. Using anti-cone-opsin antiserum CERN 874 we have localized photoreceptors in the periventricular area of hypothalamus, near the third cerebral ventricle. We also cloned a brain opsin cDNA that, on the basis of the deduced amino acid sequence, appears to belong to the RH2 class of cone-opsins. We named the cloned cone-opsin Ps-RH2. To examine whether brain cone-opsins mediate photic entrainment of circadian locomotor rhythms, we performed post-transcriptional inactivation experiments by injecting an expression eukaryotic vector transcribing the antisense cone-opsin Ps-RH2 mRNA in the third cerebral ventricle of pinealectomized-retinectomized lizards previously entrained to a light-dark (LD) cycle. Injections of the antisense construct abolished photic entrainment of circadian locomotor rhythms of pinealectomized-retinectomized lizards to the LD cycle for 6-9 days. CERN 874 completely failed to label cells within the periventricular area of hypothalamus of brains injected with antisense construct. Thus, abolishment of photic entrainment is due to inactivation of endogenous brain cone-opsins mRNA. The present results demonstrate for the first time in a vertebrate that brain cone-opsins are part of a true circadian brain photoreceptor participating in photic entrainment of behavioural rhythms.
Descriptors: reptiles, ruin lizards, *Podarcis sicula*, circadian brain photoreceptors, photic entrainment, behavioral rhythms.

Peng, Q.L., L.W. Nie, and Y.G. Pu (2006). **Complete mitochondrial genome of Chinese big-headed turtle, *Platysternon megacephalum*, with a novel gene organization in vertebrate mtDNA.** *Gene* 380(1): 14-20. ISSN: 0378-1119.
Abstract: The mitochondrial genome of the Chinese big-headed turtle, *Platysternon megacephalum*, was obtained using polymerase chain reaction (PCR). The entire mtDNA sequence, the longest mitochondrial genome in turtles reported so far, is 19161 bp. This mitochondrial genome exhibits a novel gene order, which greatly differs from that of any other vertebrates. It is characterized by four distinctive features: 1) the translocation of a gene cluster including three tRNA genes (tRNAHis, tRNASer, tRNALeu(CUN)) and ND5 gene, 2) two tRNAThr pseudogenes, 3) a duplication of pseudo tRNAThr/tRNAPro/D-loop region and 4) 3 non-coding spacers. These unique identities represent a new mitogenomic gene order in vertebrates. The TDRL model was proposed to account for the generation of the gene order in *P. megacephalum*.
Descriptors: Chinese big-headed turtle, *Platysternon megacephalum*, mitochondrial genetics, genes, mitochondrial, turtles genetics, base sequence, DNA primers genetics, DNA, intergenic genetics, gene duplication, gene rearrangement, genome, models, genetic, molecular sequence data, multigene family, nucleic acid conformation, polymerase chain reaction, pseudogenes, transfer, pro genetics, transfer, thr chemistry, RNA, transfer, thr genetics, sequence homology, nucleic acid, translocation genetic, vertebrates genetics.

Perry, G. and R.N. Fisher (2006). **Night lights and reptiles: Observed and potential effects.** In: C. Rich and T. Longcore (Editors), *Ecological Consequences of Artificial Night Lighting,* Island Press: Washington, DC, p. 169-191. ISBN: 1559631287.

NAL Call Number: QH545.E98 E26 2006
Descriptors: reptiles, artificial night lighting, ecological consequences.

Pook, C.E. and R. McEwing (2005). **Mitochondrial DNA sequences from dried snake venom: a DNA barcoding approach to the identification of venom samples.** *Toxicon* 46(7): 711-715. ISSN: 0041-0101.
NAL Call Number: 391.8 T66
Descriptors: reptiles, dried snake venom, mitochondrial DNA, barcoding, identification, venom samples, *Crotalus*, venomous pitvipers.

Poschadel, J.R. and D. Moeller (2004). **A versatile field method for tissue sampling on small reptiles and amphibians, applied to pond turtles, newts, frogs and toads.** *Conservation Genetics* 5(6): 865-867. ISSN: 1566-0621.
NAL Call Number: QH75.A1 C56
Descriptors: reptiles, tissue sampling, versatile field method, small reptiles, amphibians, pond turtles, newts, frogs, toads.

Price, E.R., F.V. Paladino, K.P. Strohl, Santidrian T P, K. Klann, and J.R. Spotila (2007). **Respiration in neonate sea turtles.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 146(3): 422-428. ISSN: 1095-6433.
Abstract: The pattern and control of respiration is virtually unknown in hatchling sea turtles. Using incubator-raised turtles, we measured oxygen consumption, frequency, tidal volume, and minute volume for leatherback (*Dermochelys coriacea*) and olive ridley (*Lepidochelys olivacea*) turtle hatchlings for the first six days after pipping. In addition, we tested the hatchlings' response to hypercapnic, hyperoxic, and hypoxic challenges over this time period. Hatchling sea turtles generally showed resting ventilation characteristics that are similar to those of adults: a single breath followed by a long respiratory pause, slow frequency, and high metabolic rate. With hypercapnic challenge, both species responded primarily by elevating respiratory frequency via a decrease in the non-ventilatory period. Leatherback resting tidal volume increased with age but otherwise, neither species' resting respiratory pattern nor response to gas challenge changed significantly over the first few days after hatching. At the time of nest emergence, sea turtles have achieved a respiratory pattern that is similar to that of actively diving adults.
Descriptors: reptiles, neonate sea turtles, leatherback, *Dermochelys coriacea*, olive ridley, *Lepidochelys olivacea*, respiration, pattern, control, hatchling, oxygen consumption, tidal volume.

Radder, R.S., B.A. Shanbhag, and S.K. Saidapur (2004). **Yolk partitioning in embryos of the lizard, *Calotes versicolor*: maximize body size or save energy for later use?** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 301(9): 783-785. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Abstract: The hatchlings of *Calotes versicolor* and other congeners retain residual yolk for immediate post-hatching needs. Excision of 8% yolk (approximately equal residual yolk) from the eggs resulted in smaller hatchlings when compared to those emerging from sham

operated eggs. However, hatchlings in both groups retained the same amount of residual yolk. The findings suggest that residual yolk in hatchlings of *C. versicolor* is an important part of the energy budget set aside by developing embryos and that the advantages of large hatchling size are counter balanced by selection for residual yolk.
Descriptors: reptiles, lizard, *Calotes versicolor*, partitioning in embryos, maximize body size, energy use, hatchlings, yolk partitioning, residual yolk.

Radmilovich, M., A. Fernandez, and O. Trujillo Cenoz (2003). **Environment temperature affects cell proliferation in the spinal cord and brain of juvenile turtles.** *Journal of Experimental Biology.* 206(Pt 17): 3085-3093. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.00515
NAL Call Number: 442.8 B77
Abstract: The spinal cords and brains--comprising dorsal cortex (DC), medial cortex (MC) and diencephalon (Dien)--of juvenile turtles acclimated to warm temperature [27-30 degrees C; warm-acclimated turtles (WATs)] revealed higher density values of bromodeoxyuridine-labeled cells (BrdU-LCs) than those acclimated to a cooler environment [5-14 degrees C; cold-acclimated turtles (CATs)]. Both populations were under the influence of the seasonal daily light-dark rhythms. Pronounced differences between WATs and CATs (independent t-test; confidence level, P<0.01) were found in the central area of the spinal gray matter and in the ependymal epithelium lining the brain ventricles. Forebrain regions (DC, MC and Dien) also revealed significant differences between WATs and CATs (independent t-test; confidence level, P<0.01-0.05). Unexplored biological clocks that may be affecting cell proliferation were equalized by performing paired experiments involving one WAT and one CAT. Both animals were injected on the same day at the same time and both were sacrificed 24 h later. These experiments confirmed that a warm environment increased cell proliferation in the CNS of turtles. Double- and triple-labeling experiments involving anti-BrdU antibody together with anti-glial protein antibodies revealed that temperature modulates not only cell populations expressing glial markers but also other cells that do not express them. As expected, in the case of short post-injection (BrdU) surviving time points, no cells were found colabeling for BrdU and NeuN (neuronal marker). The probable direct effect of temperature on the cell division rate should be analyzed together with potential indirect effects involving increased motor activity and increased food intake. The fate of the increased BrdU-LCs (death, permanence as progenitor cells or differentiation following neuronal or glial lines) remains a matter for further investigation. Results are discussed in the light of current opinions concerned with post-natal neurogenesis in vertebrates.
Descriptors: reptiles, juvenile turtles, environmental temperature, affects, cell proliferation, spinal cord, brain.

Ramadan, A.R., M.M.E.w. Aziza, and M.H.Y. Olfat (2006). **Comparative histological and ultrastructural studies of the gastric mucosa of lacertilian lizards in correlation with their feeding habits.** *Journal of the Egyptian German Society of Zoology* 49(C): 17-41. ISSN: 1110-5356.
NAL Call Number: QL1.E49
Descriptors: reptiles, lacertilian lizards, feeding habits, gastric mucosa, studies, histological,

ultrastructural, comparative, mucosal layers.
Language of Text: Arabic; English.

Reina, R.D., T.T. Jones, and J.R. Spotila (2002). **Salt and water regulation by the leatherback sea turtle *Dermochelys coriacea.*** *Journal of Experimental Biology* 205(Pt 13): 1853-1860. ISSN: 0022-0949.
NAL Call Number: 442.8 B77
Abstract: We measured the salt and water balance of hatchling leatherback sea turtles, *Dermochelys coriacea*, during their first few days of life to investigate how they maintain homeostasis under the osmoregulatory challenge of a highly desiccating terrestrial environment and then a hyperosmotic marine environment. Hatchlings desiccated rapidly when denied access to sea water, with their hematocrit increasing significantly from 30.32+/-0.54 % to 38.51+/-1.35 % and plasma Na(+) concentration increasing significantly from 138.2+/-3.3 to 166.2+/-11.2 mmol l(-1) in 12 h. When hatchlings were subsequently put into sea water, hematocrit decreased and plasma Na(+) concentration was unchanged but both were significantly elevated above pretreatment values. In other hatchlings kept in sea water for 48 h, body mass and plasma Na(+) concentration increased significantly, but hematocrit did not increase. These data show that hatchlings were able to osmoregulate effectively and gain mass by drinking sea water. We stimulated hatchlings to secrete salt from the salt glands by injecting a salt load of 27 mmol kg(-1). The time taken for secretion to begin in newly hatched turtles was longer than that in 4-day-old hatchlings, but the secretory response was identical at 4.15+/-0.40 and 4.13+/-0.59 mmol Na(+) kg(-1) h(-1) respectively. Adrenaline and methacholine were both potent inhibitors of salt gland secretion in a dose-dependent manner, although methacholine administered simultaneously with a subthreshold salt load elicited a transient secretory response. The results showed that hatchling leatherbacks are able to tolerate significant changes in internal composition and efficiently use their salt glands to establish internal ionic and water balance when in sea water.
Descriptors: reptiles, leatherback sea turtle, *Dermochelys coriacea*, salt regulation, water regulation, balance, osmoregulatory challenge, hatchlings.

Reisen, W.K., A.C. Brault, V.M. Martinez, Y. Fang, K. Simmons, S. Garcia, E. Omi Olsen, and R.S. Lane (2007). **Ability of transstadially infected *Ixodes pacificus* (Acari: Ixodidae) to transmit West Nile virus to song sparrows or western fence lizards.** *Journal of Medical Entomology* 44(2): 320-327. ISSN: 0022-2585.
NAL Call Number: 421 J828
Abstract: The hypothesis that *Ixodes pacificus* Cooley & Kohls (Acari: Ixodidae) may serve as a reservoir and vector of West Nile virus (family Flaviviridae, genus Flavivirus, WNV) in California was tested by determining the ability of this tick species to become infected with the NY99 strain of WNV while feeding on viremic song sparrows, to maintain the infection transstadially, and then to transmit WNV to recipient naive song sparrows and western fence lizards during the nymphal stage. The percentage of ticks testing positive by reverse transcription-polymerase chain reaction (RT-PCR) decreased from 77% of 35 larvae at day 6 after ticks were transferred to donor song sparrows (day of detachment) to 23% of 35 nymphs at 59 d postinfestation (approximately 19 d after molting to the nymphal stage). However, the

percentage of ticks positive by RT-PCR from which infectious virus was recovered by Vero cell assay decreased from 59% on day 6 to 12% on day 59, even though there was no statistically significant decrease in the quantity of RNA within positive ticks. Attempts to improve the sensitivity of plaque assays by blind passage through C6/36 cell cultures were unsuccessful. These data indicated that ticks maintained viral RNA but not necessarily infectious virus over time. Nymphs from larvae that fed on song sparrows with peak viremias ranging from 7.2 to 8.5 log10 plaque-forming units (PFU) per ml were used in transmission attempts. From one to seven RNA-positive nymphal ticks engorged and detached from each of four recipient song sparrows or western fence lizards. Blood samples from sparrows and lizards remained negative, indicating that transmission did not occur. An additional four lizards inoculated with 1,500 PFU of WNV developed moderate viremias, ranging from 4.2 to 5.6 log10 PFU/ml. Our data and data from previous studies collectively indicated that ixodid ticks were not able to experimentally transmit WNV and therefore most likely would not be important vectors in WNV transmission cycles.
Descriptors: reptiles, ticks, *Ixodes pacificus*, West Nile virus, sparrows, western fence lizards, disease reservoir, vector, virus transmission.

Rice, A.N., J.P. Ross, A.G. Finger, and R. Owen (2005). **Application and evaluation of a stomach flushing technique for alligators.** *Herpetological Review* 36(4): 400-401. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, *Alligator mississippiensis*, stomach flushing, safety, technique, application, evaluation.

Richardson, S.J., J.A. Monk, C.A. Shepherdley, L.O. Ebbesson, F. Sin, D.M. Power, P.B. Frappell, J. Kohrle, and M.B. Renfree (2005). **Developmentally regulated thyroid hormone distributor proteins in marsupials, a reptile, and fish.** *American Journal of Physiology. Regulatory, Integrative and Comparative Physiology* 288(5): R1264-R1272. ISSN: print: 0363-6119; online: 1522-1490.
Online: http://dx.doi.org/10.1152/ajpregu.00793.2004
Abstract: Thyroid hormones are essential for vertebrate development. There is a characteristic rise in thyroid hormone levels in blood during critical periods of thyroid hormone-regulated development. Thyroid hormones are lipophilic compounds, which readily partition from an aqueous environment into a lipid environment. Thyroid hormone distributor proteins are required to ensure adequate distribution of thyroid hormones, throughout the aqueous environment of the blood, and to counteract the avid partitioning of thyroid hormones into the lipid environment of cell membranes. In human blood, these proteins are albumin, transthyretin and thyroxine-binding globulin. We analyzed the developmental profile of thyroid hormone distributor proteins in serum from a representative of each order of marsupials (*M. eugenii; S.crassicaudata*), a reptile (*C. porosus*), in two species of salmonoid fishes (*S. salar; O. tshawytsch*), and throughout a calendar year for sea bream (*S. aurata*). We demonstrated that during development, these animals have a thyroid hormone distributor protein present in their blood which is not present in the adult blood. At least in mammals, this additional protein has higher affinity for thyroid hormones than the thyroid hormone distributor proteins in the blood of the adult. In fish, reptile and polyprotodont marsupial,

this protein was transthyretin. In a diprotodont marsupial, it was thyroxine-binding globulin. We propose an hypothesis that an augmented thyroid hormone distributor protein network contributes to the rise in total thyroid hormone levels in the blood during development.
Descriptors: reptiles, alligators, crocodiles, metabolism, fish, thyroid hormone, developmentally regulated, distributor proteins, vertebrate development, blood, marsupials.

Rittenhouse, C.D., J.J. Millspaugh, B.E. Washburn, and M.W. Hubbard (2005). **Effects of radiotransmitters on fecal glucocorticoid metabolite levels of three-toed box turtles in captivity.** *Wildlife Society Bulletin* 33(2): 706-713. ISSN: 0091-7648.
NAL Call Number: SK357.A1W5
Descriptors: reptiles, three-toed box turtles, *Terrapene carolina triunguis*, radiotransmitters, effects, fecal glucocorticoid metabolite levels, captivity.

Rogovin, K.A. and D.V. Semenov (2003). **On methods of age determination in desert lizards: Natural longevity in toad-headed lizards (*Phrynocephalus*) (Reptilia, Agamidae).** *Zoologicheskii Zhurnal* 82(7): 862-864. ISSN: 0044-5134.
Descriptors: reptiles, toad headed lizards, *Phrynocephalus*, age determination, methods, desert lizards.
Language of Text: Russian; Summary in English.

Romero, L.M. and M. Wikelski (2006). **Diurnal and nocturnal differences in hypothalamic-pituitary-adrenal axis function in Galapagos marine iguanas.** *General and Comparative Endocrinology* 145(2): 177-181. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: reptiles, Galapagos marine iguana, *Amblyrhynchus cristatus*, hypothalamic pituitary adrenal axis function, diurnal, nocturnal differences.

Rose, R.J., J. Ng, and J. Melville (2006). **A technique for restraining lizards for field and laboratory measurements.** *Herpetological Review* 37(2): 194-195. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, lizards, restraining, field, laboratory, measurements, technique.

Rowe, C.L. and S.M. Kelly (2005). **Marking hatchling turtles via intraperitoneal placement of PIT tags: Implications for long-term studies.** *Herpetological Review* 36(4): 408-410. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, hatchling turtles, *Chrysemys picta*, marking, PIT tags, intraperitoneal placement, long term studies.

Rubenstein, D.R. and M. Wikelski (2005). **Steroid hormones and aggression in female Galapagos marine iguanas.** *Hormones and Behavior* 48(3): 329-341. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Descriptors: reptiles, Galapagos marine iguanas, steroid hormones, aggression, female.

Sakata, J.T., S.C. Woolley, A. Gupta, and D. Crews (2003). **Differential effects of testosterone and progesterone on the activation and retention of courtship behavior in sexual and parthenogenetic whiptail lizards.** *Hormones and Behavior* 43(5): 523-530. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Abstract: Both testosterone (T) and progesterone (P) facilitate the expression of male-typical sexual behavior in a variety of animals, including rodents and lizards. In two species of whiptail lizards, *Cnemidophorus inornatus* and *C. uniparens*, both hormones elicit the full repertoire of courtship behavior. However, the relative efficacy of the two hormones is unknown. In Experiments 1 and 2 we assessed differences in capacity of exogenous T and P to induce male-typical courtship behavior in gonadectomized whiptail lizards. In both species, individuals implanted with T showed more frequent courtship behavior relative to those implanted with P or cholesterol. In Experiments 3 and 4 we examined whether T and P differentially affected the retention of courtship behavior following implant removal. In both species, individuals implanted with T showed more courtship behavior following implant removal than those previously given P. In these experiments, implants were removed at a time when individuals in both groups were behaviorally similar; therefore, the differences in behavior following implant removal were not due to differences in the amount of courtship experience. Taken together, the hormone that was more effective at activating courtship behavior was also more effective at maintaining courtship behavior following implant removal. In summary, though both T and P can elicit identical sexual behaviors in both whiptail species, T has a greater and more lasting effect on courtship behavior and possibly on the neural circuits underlying courtship behavior.
Descriptors: reptiles, whiptail lizards, *Cnemidophorus inornatus* and *C. uniparens*, courtship, behavior, testosterone, progesterone, differential effects, activation, retention.

Secor, S.M. and T.R. Nagy (2003). **Non-invasive measure of body composition of snakes using dual-energy X-ray absorptiometry.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 136(2): 379-389. ISSN: 1095-6433.
Abstract: Non-invasive techniques to measure body composition are critical for longitudinal studies of energetics and life histories and for investigating the link between body condition and physiology. Previous attempts to determine, non-invasively, the body composition of snakes have proven problematic. Therefore, we explored whether dual-energy X-ray absorptiometry (DXA) could be used to determine the body composition of snakes. We analyzed 20 adult diamondback water snakes (*Nerodia rhombifer*) with a DXA instrument and subsequently quantified their body composition by gravimetric and chemical extraction methods. Body composition components scaled with body mass with mass exponents between 0.88 and 1.53. DXA values for lean tissue mass, fat mass and total-body bone mineral mass were significantly correlated with observed masses of lean tissue, fat and ash from chemical analysis. Using regression models incorporating DXA values we predicted the fat-free tissue mass, lean tissue mass, fat mass, ash mass and total body water content for this sample of water snakes. A cross-validation procedure demonstrated that these models estimated fat-free tissue mass, lean tissue mass, fat mass, ash mass and total-body water content with respective errors of 2.2%, 2.3%, 16.0%, 6.6% and 3.5%. Compared to other non-invasive techniques, include body condition indices, total body electrical conductivity (TOBEC) and

cyclopropane absorption, DXA can more easily and accurately be used to determine the body composition of snakes.
Descriptors: reptiles, snakes, body composition, Colubridae metabolism, densitometry , duel-energy X ray absorptiometry.

Selcer, K.W., L.M. Nespoli, T.R. Rainwater, A.G. Finger, D.A. Ray, S.G. Platt, P.N. Smith, L.D. Densmore, and S.T. McMurry (2006). **Development of an enzyme-linked immunosorbent assay for vitellogenin of Morelet's crocodile (*Crocodylus moreletii*).** *Comparative Biochemistry and Physiology. Part C Toxicology and Pharmacology* 143(1): 50-58. ISSN: 1532-0456.
Abstract: The purpose of this study was to develop an immunoassay for vitellogenin in Morelet's crocodile (*Crocodylus moreletii*). Blood was collected from wild-caught crocodiles in Belize. Plasma samples from adult females taken during the breeding season were used for vitellogenin purification and samples from adult males were used for comparison. No differences were detected between males and females for plasma total protein concentration, as measured by Coomassie assay. However, denaturing polyacrylamide gel electrophoresis (SDS-PAGE) revealed that female plasma contained a 210-kDa protein, presumably the vitellogenin monomer, that was absent in adult male plasma. The identity of the putative vitellogenin was confirmed by its cross-reactivity in Western blots with a vitellogenin antiserum that was generated against a conserved vitellogenin peptide sequence. Crocodile vitellogenin was purified by two successive rounds of DEAE chromatography. The purified protein had an apparent molecular mass of 450 kDa, as determined by gel filtration chromatography, and 210 kDa on SDS-PAGE. An indirect enzyme-linked immunosorbent assay (ELISA) was then developed for *C. moreletii* vitellogenin. The detection limit of the assay was 20.0 ng/mL. The intra- and inter-assay coefficients of variation were 5.3% and 9.8%, respectively. The recovery of vitellogenin diluted into male plasma was 94.7%. The ELISA assay revealed that vitellogenin levels of adult female plasma during the breeding season ranged from 1.8 to 3.1 mg/mL with a mean of 2.5+/-0.25 mg/mL. No vitellogenin was detected in adult male plasma. Induction of vitellogenin in Morelet's crocodile may be a useful model system for field studies of crocodile reproduction and for investigations of endocrine disruption in this species.
Descriptors: alligators and crocodiles, enzyme linked immunosorbent assay, vitellogenins analysis, vitellogenins isolation and purification, molecular weight, vitellogenins chemistry, vitellogenins immunology.

Sells, P.G. (2003). **Animal experimentation in snake venom research and in vitro alternatives**. *Toxicon* 42(2): 115-133. ISSN: 0041-0101.
NAL Call Number: 391.8 T66
Descriptors: reptiles, snakes, animal models, envenomation, laboratory animals, rodents, reviews, snake bites, venoms, reduction, alternatives.

Sever, D.M. (2004). **Ultrastructure of the reproductive system of the black swamp snake (*Seminatrix pygaea*). IV. Occurrence of an ampulla ductus deferentis.** *Journal of Morphology* 262(3): 714-730. ISSN: 0362-2525.
NAL Call Number: 444.8 J826

Abstract: The distal end of the ductus deferens of *Seminatrix pygaea* (Cope) differs from more proximal portions of the tube by possessing a highly fluctuated epithelium. Similar morphology has been reported in this area in one lizard and some mammals and the region has been designated in these taxa as the ampulla ductus deferentis. In this study, light and transmission electron microscopy were used to study the posterior ductus deferens in *S. pygaea* and compare the histology in this region to more proximal regions of the duct and to descriptions of the ampulla of other species. *Seminatrix pygaea* stores sperm throughout the ductus deferens during the entire year. The epithelium of the ductus deferens is not secretory, but the presence of numerous small apical vesicles indicates a role in fluid absorption. In addition to the highly folded epithelium, clusters of sperm nuclei are more intimately associated with the apical ampullary epithelium than elsewhere in the ductus deferens. No evidence of phagocytosis of sperm was found. In contrast, the ampulla of mammals and presumably the lizard *Calotes versicolor* is glandular and phagocytic. The common character shared by the squamates and mammals with specializations in this area is the folded epithelium, and whether this is due to shared ancestry with amniotes or is homoplastic is unresolved.
Descriptors: reptiles, black swamp snake, *Seminatrix pygaea*, lizard, *Calotes versicolor*, reproductive system, ultrastructure, ampulla ductus deferentis.

Sever, D.M., R.A. Stevens, T.J. Ryan, and W.C. Hamlett (2002). **Ultrastructure of the reproductive system of the black swamp snake (*Seminatrix pygaea*). III. Sexual segment of the male kidney.** *Journal of Morphology* 252(3): 238-254. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: reptiles, black swamp snake, *Seminatrix pygaea*, reproductive system, ultrastructure, male kidney, sexual segment.

Skovgaard, N., D.E. Warren, D.C. Jackson, and T. Wang (2005). **Endothelin-1 causes systemic vasodilatation in anaesthetised turtles (*Trachemys scripta*) through activation of ETB-receptors.** *Journal of Experimental Biology.* 208(Pt 19): 3739-3746. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01834
NAL Call Number: 442.8 B77
Abstract: The effects of endothelin-1 (ET-1) on systemic and pulmonary circulation were investigated in anaesthetised freshwater turtles (*Trachemys scripta*) instrumented with arterial catheters and blood flow probes. Bolus intra-arterial injections of ET-1 (0.4-400 pmol kg(-1)) caused a dose-dependent systemic vasodilatation that was associated with a decrease in systemic pressure (P(sys)) and a rise in systemic blood flow (Q(sys)), causing systemic conductance (G(sys)) to increase. ET-1 had no significant effects on the pulmonary vasculature, heart rate (fh) or total stroke volume (Vs(tot)). This response differs markedly from mammals, where ET-1 causes an initial vasodilatation that is followed by a pronounced pressor response. In mammals, the initial dilatation is caused by stimulation of ET(B)-receptors, while the subsequent constriction is mediated by ET(A)-receptors. In the turtles, infusion of the ET(B)-receptor agonist BQ-3020 (150 pmol kg(-1)) elicited haemodynamic changes that were similar to those of ET-1, and the effects of ET-1 were not affected by the ET(A)-antagonist BQ-610 (0.15 micromol kg(-1)). Conversely, all effects of ET-1 were vir-

tually abolished after specific ET(B)-receptor blockade with the ET(B)-antagonist BQ-788 (0.15 micromol kg(-1)). The subsequent treatment with the general ET-receptor antagonist tezosentan (15.4 micromol kg(-1)) did not produce effects that differed from the treatment with ET(B)-antagonist, and the blockade of ET-1 responses persisted. This present study indicates, therefore, that ET(B)-receptors are responsible for the majority of the cardiovascular responses to ET-1 in Trachemys.
Descriptors: turtles, *Trachemys scripta*, anesthetised, systemic vasodilatation, blood flow, endothelin-1 , pulmonary circulation, ETB recptors.

Sneary, M.G. and E.R. Lewis (2007). **Tuning properties of turtle auditory nerve fibers: Evidence for suppression and adaptation.** *Hearing Research* 228(1-2): 22-30. ISSN: 0378-5955.
Abstract: Second-order reverse correlation (second-order Wiener-kernel analysis) was carried out between spike responses in single afferent units from the basilar papilla of the red-eared turtle and band limited white noise auditory stimuli. For units with best excitatory frequencies (BEFs) below approximately 500Hz, the analysis revealed suppression similar to that observed previously in anuran amphibians. For units with higher BEFs, the analysis revealed dc response with narrow-band tuning centered about the BEF, combined with broad-band ac response at lower frequencies. For all units, the analysis revealed the relative timing and tuning of excitation and various forms of inhibitory or suppressive effects.
Descriptors: reptiles, turtle auditory nerve fibers, tuning properties, suppression, adaptation, auditory stimuli, basal papilla, frequencies.

Stamper, M.A., M.G. Papich, G.A. Lewbart, S.B. May, D.D. Plummer, and M.K. Stoskopf (2003). **Pharmacokinetics of florfenicol in loggerhead sea turtles (*Caretta caretta*) after single intravenous and intramuscular injections.** *Journal of Zoo and Wildlife Medicine* 34(1): 3-8. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Abstract: The pharmocodynamics of single injections of florfenicol in yearling loggerhead sea turtles (*Caretta caretta*) were determined. Eight juvenile loggerhead sea turtles weighing 1.25 (+/- 0.18) kg were divided into two groups. Four animals received 30 mg/kg of florfenicol i.v., and four received the same dose i.m. Plasma florfenicol concentrations were analyzed by reverse-phase high performance liquid chromatography. After the i.v. dose, there was a biphasic decline in plasma florfenicol concentration. The initial steep phase from 3 min to 1 hr had a half-life of 3 min, and there was a longer slow phase of elimination, with a half-life that ranged from 2 to 7.8 hr among turtles. The volume of distribution varied greatly and ranged from 10.46 to -60 L/kg. Clearance after the i.v. dose was 3.6-6.3 L/kg/hr. After the i.m. injection, there was a peak within 30 min of 1.4-5.6 microg/ml, and florfenicol was thereafter eliminated with a half-life of 3.2-4.3 hr. With either route, florfenicol plasma concentrations were below the minimum inhibitory concentrations for sensitive bacteria within 1 hr. Florfenicol does not appear to be a practical antibiotic in sea turtles when administered at these doses.
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, florfenicol, pharmacokinetics, single injection, intravenous, intramuscular, plasma concentrations.

Stawski, C.Y., G.C. Grigg, D.T. Booth, and L.A. Beard (2006). **Temperature and the respiratory properties of whole blood in two reptiles, *Pogona barbata* and *Emydura signata.*** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 143(2): 173-183. ISSN: 1095-6433.

Abstract: We investigated the capacity of two reptiles, an agamid lizard *Pogona barbata* and a chelid turtle *Emydura signat*a, to compensate for the effects of temperature by making changes in their whole blood respiratory properties. This was accomplished by measuring the P50 (at 10, 20 and 30 degrees C), hematocrit (Hct), haemoglobin concentration ([Hb]) and mean cell haemoglobin concentration (MCHC) in field acclimatised and laboratory acclimated individuals. The acute effect of temperature on P50 in *P. barbata*, expressed as heat of oxygenation (deltaH), ranged from -16.8+/-1.84 to -28.5+/-2.73 kJ/mole. P50 of field acclimatised *P. barbata* increased significantly from early spring to summer at the test temperatures of 20 degrees C (43.1+/-1.2 to 48.8+/-2.1 mmHg) and 30 degrees C (54.7+/-1.2 to 65.2+/-2.3 mmHg), but showed no acclimation under laboratory conditions. For *E. signata*, deltaH ranged from -31.1+/-6.32 to -48.2+/-3.59 kJ/mole. Field acclimatisation and laboratory acclimation of P50 did not occur. However, in *E. signata*, there was a significant increase in [Hb] and MCHC from early spring to summer in turtles collected from the wild (1.0+/-0.1 to 1.7+/-0.2 mmol/L and 4.0+/-0.3 to 6.7+/-0.7 mmol/L, respectively).

Descriptors: reptiles, turtle, *Emydura signata*, lizard, *Pogona barbata*, temperature, respiratory properties, whole blood, acclimation.

Stein, P.S. (2005). **Neuronal control of turtle hindlimb motor rhythms.** *Journal of Comparative Physiology. A, Neuroethology, Sensory, Neural, and Behavioral Physiology* 191(3): 213-229. ISSN: 0340-7594.

NAL Call Number: QP33.J68

Abstract: The turtle, *Trachemys scripta elegans*, uses its hindlimb during the rhythmic motor behaviors of walking, swimming, and scratching. For some tasks, one or more motor strategies or forms may be produced, e.g., forward swimming or backpaddling. This review discusses experiments that reveal characteristics of the spinal neuronal networks producing these motor behaviors. Limb-movement studies show shared properties such as rhythmic alternation between hip flexion and hip extension, as well as variable properties such as the timing of knee extension in the cycle of hip movements. Motor-pattern studies show shared properties such as rhythmic alternation between hip flexor and hip extensor motor activities, as well as variable properties such as modifiable timing of knee extensor motor activity in the cycle of hip motor activity. Motor patterns also display variations such as the hip-extensor deletion of rostral scratching. Neuronal-network studies reveal mechanisms responsible for movement and motor-pattern properties. Some interneurons in the spinal cord have shared activities, e.g., each unit is active during more than one behavior, and have distinct characteristics, e.g., each unit is most excited during a specific behavior. Interneuronal recordings during variations support the concept of modular organization of central pattern generators in the spinal cord.

Descriptors: reptiles, turtle, *Trachemys scripta elegans*, neuronal control , hindlimb motor rhythms, walking, swimming, scratching, review.

Steinman, A., C. Banet Noach, L. Simanov, N. Grinfeld, Z. Aizenberg, O. Levi, D. Lahav, M. Malkinson, S. Perk, and N.Y. Shpigel (2006). **Experimental infection of common garter snakes (T *hamnophis sirtalis*) with west nile virus**. *Vector Borne and Zoontic Diseases* 6(4): 361-368. ISSN: 1530-3667.
NAL Call Number: RA639.5.V43
Descriptors: reptiles, common garter snakes, T*hamnophis sirtalis*, experimental infection, West Nile virus, subcutaneously, orally, viremic, titers, viral RNA.

Stewart, J.R. and K.R. Brasch (2003). **Ultrastructure of the placentae of the natricine snake, *Virginia striatula* (Reptilia: Squamata).** *Journal of Morphology* 255(2): 177-201. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: reptiles, natricine snake, *Virginia striatula*, placenta, ultrastructure.

Sun, W., P. Neuzil, T.S. Kustandi, S. Oh, and V.D. Samper (2005). **The nature of the gecko lizard adhesive force.** *Biophysical Journal* 89(2): L14-L17. ISSN: print: 0006-3495; online: 1542-0086.
Abstract: The extraordinary climbing skills of gecko lizards have been under investigation for a long time. Here we report results of direct measurement of single spatula forces in air with varying relative humidities and in water, by the force-distance method using an atomic force microscope. We have found that the presence of water strongly affects the adhesion force and from analysis of our results, we have demonstrated that the dominant force involved is the capillary force.
Descriptors: reptiles, gecko, epidermis physiology, ultrastructure, foot anatomy, histology, lizards anatomy, adhesive force, nature, locomotion stress, capillary force.

Tessier, N. and F.J. Lapointe (2003). **Comparative efficiency of different sampling techniques to obtain DNA from freshwater turtles.** *Chelonian Conservation and Biology* 4(3): 710-712. ISSN: 1071-8443.
Descriptors: reptiles, freshwater turtles, obtain DNA, different samplng techniques, comparative efficiency.

Thammasirirak, S., P. Ponkham, S. Preecharram, R. Khanchanuan, P. Phonyothee, S. Daduang, C. Srisomsap, T. Araki, and J. Svasti (2006). **Purification, characterization and comparison of reptile lysozymes.** *Comparative Biochemistry and Physiology Part C Toxicology and Pharmacology* 143(2): 209-217. ISSN: 1532-0456.
Descriptors: reptiles, turtles, lysozymes, purification, characterization, gel filtration chromatography, comparison.

Thomson, M., J.F. Herbert, and M.B. Thompson (2006). **Tyrosine phosphorylated proteins in the reproductive tract of the viviparous lizard *Eulamprus tympanum* and the oviparous lizard *Lampropholis guichenoti.*** *Comparative Biochemistry and Physiology. Part B, Biochemistry and Molecular Biology* 144(3): 382-386. ISSN: 1096-4959.
Abstract: Plastic changes occur in the morphology of the uterus at various stages of the

reproductive cycle in both oviparous and viviparous lizards and these may be influenced by estrogen. Estrogen driven phosphorylation of effector proteins on tyrosine residues plays a major role in the plastic modulation of uterine anatomy and physiology in vertebrates. We used electrophoresis and Western blotting to characterize the phosphotyrosine protein profiles at various stages of the reproductive pathway in an oviparous lizard Lampropholis guichenoti and a viviparous lizard *Eulamprus tympanum. L. guichenoti* displayed major bands in the 200-35 kDa range and a triplet of bands of molecular masses 61 kDa, 52 kDa and 48 kDa in 50% of specimens and a 38 kDa band in all specimens. In contrast, *E. tympanum* samples all displayed a single major band at 40 kDa, which was significantly elevated at the early pregnancy stage. Somewhat paradoxically, the viviparous species, which has the more complex uterine epithelial changes during pregnancy, has the fewest phosphotyrosine bands, so how tyrosine phosphorylation is affected during the evolution of viviparity is not clear.
Descriptors: reptiles, viviparous lizard, *Eulamprus tympanum*, oviparous lizard, *Lampropholis guichenoti*, reproductive tract, tyrosine phosphorylated proteins, reproductive cycle.

Tourmente, M., G.A. Cardozo, H.A. Guidobaldi, L.C. Giojalas, M. Bertona, and M. Chiaraviglio (2007). **Sperm motility parameters to evaluate the seminal quality of *Boa constrictor occidentalis*, a threatened snake species.** *Research in Veterinary Science* 82(1): 93-98. ISSN: 0034-5288.
Abstract: Semen quality analysis constitutes a powerful tool to evaluate the fertility potential of males in threatened species. The Argentine boa constrictor or lampalagua (*Boa constrictor occidentalis*) is a threatened snake species and has been included in Appendix I of CITES. The objective of this work is to characterize the sperm of *B. c. occidentalis* on the bases of dynamic parameters to improve this species conservation. Dynamic parameters were measured in sperm samples using videomicroscopy and image analysis software. The sperm population showed a high degree of heterogeneity in velocity parameter values and 95% of the cells showed a linear pattern of movement. Studies in other species indicate that the number of motile spermatozoa and their movement speed is directly correlated with fertilization success. This work will help to establish basic parameter values for the evaluation of the reproductive potential of populations of *B. c. occidentalis* and to resolve questions referred to its reproductive strategies.
Descriptors: reptiles, snake, *Boa constictor occidentalis*, sperm motility parameters, seminal quality, motile spermatazoa.

Tu, Z.C., W. Eisner, B.N. Kreiswirth, and M.J. Blaser (2005). **Genetic divergence of *Campylobacter fetus* strains of mammal and reptile origins.** *Journal of Clinical Microbiology* 43(7): 3334-3340. ISSN: 0095-1137.
Online: http://dx.doi.org/10.1128/JCM.43.7.3334-3340.2005
NAL Call Number: QR46.J6
Abstract: *Campylobacter fetus* is a gram-negative bacterial pathogen of both humans and animals. Two subspecies have been identified, *Campylobacter fetus subsp. fetus* and *Campylobacter fetus subsp. venerealis*, and there are two serotypes, A and B. To further investigate the genetic diversity among *C. fetus* strains of different origins, subspecies, and serotypes, we performed multiple genetic analyses by utilizing random amplification of polymorphic DNA

(RAPD), pulsed-field gel electrophoresis (PFGE), and DNA-DNA hybridization. All 10 primers used for the RAPD analyses can distinguish *C. fetus* strains of reptile and mammal origin, five can differentiate between *C. fetus subsp. fetus* and *C. fetus subsp. venerealis* strains, and four showed differences between type A and type B isolates from mammals. PFGE with SmaI and SalI digestion showed varied genome patterns among different *C. fetus* strains, but for mammalian *C. fetus* isolates, genome size was well conserved (mean, 1.52 +/- 0.06 Mb for SmaI and 1.52 +/- 0.05 Mb for SalI). DNA-DNA hybridization demonstrated substantial genomic-homology differences between strains of mammal and reptile origin. In total, these data suggest that *C. fetus subsp fetus* strains of reptile and mammal origin have genetic divergence more extensive than that between the two subspecies and that between the type A and type B strains. Combining these studies with sequence data, we conclude that there has been substantial genetic divergence between *Campylobacter fetus* of reptile and mammal origin. Diagnostic tools have been developed to differentiate among *C. fetus* isolates for taxonomic and epidemiologic uses.

Descriptors: reptiles, campylobacter infections, microbiology, *Campylobacter fetus*, cattle, turtles, bacterial analysis.

Turgut, M., S. Kaplan, K. Metin, Y.B. Koca, E. Soylu , B. Sahin, Z.B. Ateslier, and H.K. Basaloglu (2006). **Effects of constant lightness, darkness and parachlorophenylalanine treatment on tail regeneration in the lizard *Ophisops elegans macrodactylus*: macroscopic, biochemical and histological changes.** *Anatomia, Histologia, Embryologia* 35(3): 155-161. ISSN: 0340-2096.

Abstract: A better understanding of regenerative growth is very important for the development of new potential strategies. Recently, the pineal secretory product melatonin was shown to stimulate the regeneration process. In this study, we carried out an experimental investigation of tail regeneration in young adult lizards, *Ophisops elegans macrodactylus* Berthold, 1842, addressing the role of melatonin on the regeneration process. Lizards were divided into three groups: constant light-exposed control group (n = 13), constant dark-exposed group (n = 15) and parachlorophenylalanine (p-CPA) treatment group exposed to constant light (n = 15). Using a tail autotomy procedure, the effects of p-CPA treatment on connective tissue together with neural tissue and vascular tissue in regenerating tail in lizards were investigated. p-CPA (400 microg/kg body mass) was injected from day 0 to 30 days after autotomy. p-CPA treatment produced a significant increase in the length of the regenerated tail compared with light-exposed control and dark-exposed lizards. Total collagen content was found to be higher in p-CPA-treated animals in comparison with other groups. Histologically, a higher percentage of connective tissue and vascular tissue and a lower percentage of neural tissue were found in the regenerated tails of the p-CPA-treated lizards. Importantly, the percentage of neural tissue in lizards in the dark-exposed animals was higher than that in animals of both light-exposed and p-CPA treatment groups. Thus, it is clear that p-CPA has a stimulatory influence on fibroblast collagen production and vascularization of the regenerated tail in the lizards. Furthermore, it seems that the neural regeneration process was markedly enhanced in lizards exposed to continuous darkness. Based on the results of our study, it is suggested that melatonin may be an active factor that speeds up the rate of tail regeneration in lacertilians.

Descriptors: reptiles, *Ophisops elegans macrodactylus*, lizards physiology, melatonin physiology, pineal gland physiology, regeneration physiology, tail physiology, fenclonine pharmacology, light, random allocation, regeneration drug effects.

Turgut, M., Y.B. Koca, S. Kaplan, K. Metin, N. Uzum, E. Soylu, A. Avc, M.C. Ragbetli, E.P. Beytas, and K. Olgun (2007). **Effects of Ca2+channel blocker verapamil on tissue regeneration in a lizard tail autotomy model: a biochemical and histological study**. *Amphibia Reptilia* 28(1): 7-15. ISSN: 0173-5373.
Descriptors: reptiles, lizard, tail, autotomy model, tissue regeneration, Ca2+ channel blocker verapamil, effects.

Uller, T. and M. Olsson (2003). **Prenatal exposure to testosterone increases ectoparasite susceptibility in the common lizard (*Lacerta vivipara*).** *Proceedings of the Royal Society of London. Series B, Biological Sciences* 270(1526): 1867-1870. ISSN: 0080-4649.
Abstract: High levels of testosterone can benefit individual fitness, for example by increasing growth rate or ornament size, which may result in increased reproductive success. However, testosterone induces costs, such as a suppressed immune system, thereby generating trade-offs between growth or mate acquisition, and immunity. In birds and reptiles, females allocate steroids to their eggs, which may be a mechanism whereby females can influence the phenotype of their offspring. To our knowledge, only the benefits of early androgen exposure have been experimentally investigated to date. However, to understand this phenomenon, the costs also need to be evaluated. We manipulated testosterone levels in eggs of the viviparous common lizard and monitored growth, endurance and post-parturient responses to ectoparasites of the offspring. Testosterone-treated individuals had significantly higher growth rates than controls, but suffered a significant decrease in growth rate when exposed to ticks, whereas the corresponding difference for controls was non-significant. There was no difference in observed parasite load or leucocyte count between manipulated and control offspring. Thus, our results suggest that high testosterone levels during embryonic development have detrimental effects on immune function resulting in reduced growth rate, and that this must be taken into consideration when evaluating the potential adaptive value of maternal androgen allocation to eggs.
Descriptors: reptiles, lizard, *Lacerta vivipara*, testosterone, prenatal exposure, ectoparasite, increased suceptibility, suppressed immune system.

Varriale, A. and G. Bernardi (2006). **Dna methylation in reptiles**. *Gene* 385: 122-127. ISSN: 0378-1119.
Descriptors: reptiles, DNA methylation, fishes, warm-blooded vertebrates, evolutionary changes, body temperature, birds, amphibians.

Vieira, G.H., G.R. Colli, and S.N. Bao (2004). **The ultrastructure of the spermatozoon of the lizard *Iguana iguana* (Reptilia, Squamata, Iguanidae) and the variability of sperm morphology among iguanian lizards.** *Journal of Anatomy* 204(6): 451-464. ISSN: 0021-8782.
Abstract: The spermatozoon of *Iguana iguana* is filiform and resembles that of other iguanian lizards, being most similar to Tropidurus. All sperm synapomorphies of Tetrapoda,

Amniota and Squamata are present in the sperm of *Iguana iguana*. By reconstructing the evolution of 30 sperm characters we identified a novel synapomorphy of Iguania: the presence of a well-developed acrosomal ridge at the level of the epinuclear lucent zone. Because of the poor topological resolution among iguanian clades we could not discount the possibility of convergence or neutral selection as determinant of the variability in characteristics of the sperm cell. In agreement with previous studies, we identified heterogeneous rates of evolution among the three main regions of the sperm cell, namely the head, midpiece and tail.
Descriptors: reptiles, lizard, *Iguana iguana*, spermatozoon, ultrastructure, sperm morphology, variability.

Voituron, Y., J.M. Storey, C. Grenot, and K.B. Storey (2002). **Freezing survival, body ice content and blood composition of the freeze-tolerant European common lizard, *Lacerta vivipara*.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 172(1): 71-76. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: To investigate the freeze tolerance of the European common lizard, *Lacerta vivipara*, we froze 17 individuals to body temperatures as low as -4 degrees C under controlled laboratory conditions. The data show that this species tolerates the freezing of 50% of total body water and can survive freezing exposures of at least 24-h duration. Currently, this represents the best known development of freeze tolerance among squamate reptiles. Freezing stimulated a significant increase in blood glucose levels (16.15+/- 1.73 micromol x ml(-1) for controls versus 25.06 +/- 2.92 micromol x ml(-1) after thawing) but this increase had no significant effect on serum osmolality which was unchanged between control and freeze-exposed lizards (506.0 +/- 23.8 mosmol x l(-1) versus 501.0 +/- 25.3 mosmol x l(-1), respectively). Tests that assessed the possible presence of antifreeze proteins in lizard blood were negative. Recovery at 5 degrees C after freezing was assessed by measurements of the mean time for the return of breathing (5.9 +/- 0.5 h) and of the righting reflex (44.8 +/- 4.5 h). Because this species hibernates in wet substrates inoculative freezing may frequently occur in nature and the substantial freeze tolerance of this lizard should play a key role in its winter survival.
Descriptors: reptiles, European common lizard, *Lacerta vivipara*, freezing survival, body ice, blood composition, freeze tolerant, serum osmolality, breathing.

Voituron, Y., B. Verdier, and C. Grenot (2002). **The respiratory metabolism of a lizard (*Lacerta vivipara*) in supercooled and frozen states.** *American Journal of Physiology. Regulatory, Integrative and Comparative Physiology* 283(1): R181-R186. ISSN: print: 0363-6119; online: 1522-1490.
Online: http://dx.doi.org/10.1152/ajpregu.00378.2001
Abstract: We investigated the respiratory metabolism of the overwintering lizard *Lacerta vivipara* while in either supercooled or frozen states. With a variable pressure and volume microrespirometer and a chromatograph, we show that the oxygen consumption of the supercooled animals showed a nonlinear relationship with temperature and an aerobic metabolism demand between 0.5 and -1.5 degrees C. A significant increase in the respiratory quotient (RQ) values indicated an increasing contribution by the anaerobic pathways with decreasing temperature. In the frozen state, two phases are easily detectable and are probably

linked to the ice formation within the body. During the first 5-6 h, the animals showed an oxygen consumption of 3.52 +/- 0.28 microl. g(-1). h(-1) and a RQ value of 0.52 +/- 0.09. In contrast, after ice equilibrium, oxygen consumption decreased sharply (0.55 +/- 0.09 microl. g(-1). h(-1)) and the RQ values increased (2.49 +/- 0.65). The present study confirms the fact that supercooled invertebrates and vertebrates respond differently to subzero temperatures, in terms of aerobic metabolism, and it shows that aerobic metabolism persists under freezing conditions.
Descriptors: reptiles, lizard, *Lacerta vivipara*, cold, freezing, lizards metabolism, respiratory system metabolism, anaerobiosis, oxygen consumption, pulmonary gas exchange.

Voronov, A., G. Voronova, N. Kupriyanova, and A. Ryskov (2005). **Molecular-genetic characteristics of lizard ribosomal DNA.** *Russian Journal of Herpetology* 12(Suppl.): 105-108. ISSN: 1026-2296.
Descriptors: reptiles, lizard, molecular genetic characteristics, ribosomal DNA.

Wade, J. (2005). **Current research on the behavioral neuroendocrinology of reptiles.** *Hormones and Behavior* 48(4): 451-460. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Abstract: Selected reptilian species have been the targets of investigations in behavioral neuroendocrinology for many years. Reptiles offer a particularly powerful set of traits that facilitate comparisons at multiple levels, including those within and between individuals of a particular species, between different environmental and social contexts, as well as across species. These types of studies, particularly as they are considered within the framework of results from other vertebrates, will enhance our understanding of the genetic and hormonal influences regulating changes in the structure and function of the nervous system. Work on the hormonal and environmental factors influencing courtship and copulatory behaviors in green anoles, including the development and maintenance of the neuromuscular structures critical for their display, is highlighted. Some very recent work on other model systems is also discussed to provide a context for suggested future research directions.
Descriptors: reptiles, behavior, physiology, neurosecretory systems, physiology, reproduction physiology, sexual behavior, gonadal steroid hormones.

Wang, W., S. Luo, B.K. Ghosh, and P.S. Ulinski (2006). **Generation of the receptive fields of subpial cells in turtle visual cortex**. *Journal of Integrative Neuroscience* 5(4): 561-593. ISSN: 0219-6352.
Descriptors: reptiles, turtle visual cortex, receptive fields, generation, subpial cells, model, simulation, visual stimuli.

Warren, D.E., S.A. Reese, and D.C. Jackson (2006). **Tissue glycogen and extracellular buffering limit the survival of red-eared slider turtles during anoxic submergence at 3 degrees C.** *Physiological and Biochemical Zoology* 79(4): 736-744. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: The goal of this study was to identify the factors that limit the survival of the red-eared slider turtle *Trachemys scripta* during long-term anoxic submergence at 3 degrees C. We

measured blood acid-base status and tissue lactate and glycogen contents after 13, 29, and 44 d of submergence from ventricle, liver, carapace (lactate only), and four skeletal muscles. We also measured plasma Ca(2+), Mg(2+), Na(+), K(+), Cl(-), inorganic phosphate (P(i)), lactate, and glucose. After 44 d, one of the six remaining turtles died, while the other turtles were in poor condition and suffered from a severe acidemia (blood pH = 7.09 from 7.77) caused by lactic acidosis (plasma lactate 91.5 mmol L(-1)). An initial respiratory acidosis attenuated after 28 d. Lactate rose to similar concentrations in ventricle and skeletal muscle (39.3-46.1 micromol g(-1)). Liver accumulated the least lactate (21.8 micromol g(-1)), and carapace accumulated the most lactate (68.9 micromol g(-1)). Plasma Ca(2+) and Mg(2+) increased significantly throughout submergence to levels comparable to painted turtles at a similar estimated lactate load. Glycogen depletion was extensive in all tissues tested: by 83% in liver, by 90% in ventricle, and by 62%-88% in muscle. We estimate that the shell buffered 69.1% of the total lactate load, which is comparable to painted turtles. Compared with painted turtles, predive tissue glycogen contents and plasma HCO(-)(3) concentrations were low. We believe these differences contribute to the poorer tolerance to long-term anoxic submergence in red-eared slider turtles compared with painted turtles.
Descriptors: reptiles, painted turtles, red-eared slider turtle, *Trachemys scripta*, anoxic submergence, 3 degrees centigrade, tissue glycogen, extracellular buffering, survival.

Wassersug, R.J., L. Roberts, J. Gimian, E. Hughes, R. Saunders, D. Devison, J. Woodbury, and J.C. O'Reilly (2005). **The behavioral responses of amphibians and reptiles to microgravity on parabolic flights.** *Zoology [Jena]* 108(2): 107-120. ISSN: 0944-2006.
NAL Call Number: QL1.Z769
Abstract: In the present study, we exposed 53 animals from 23 different species of amphibians and reptiles to microgravity (mug). This nearly doubles the number of amphibians and reptiles observed so far in mug. The animals were flown on a parabolic flight, which provided 20-25s of mug, to better characterize behavioral reactions to abrupt exposure to mug. Highly fossorial limbless caecilians and amphisbaenians showed relatively limited movement in mug. Limbed quadrupedal reptiles that were non-arboreal in the genera Leiocephalus, Anolis, and Scincella showed the typical righting response and enormous amounts of body motion and tail rotation, which we interpreted as both righting responses and futile actions to grasp the substrate. Both arboreal and non-arboreal geckos in the genera Uroplatus, Palmatogecko, Stenodactylus, Tarentola, and Eublepharis instead showed a skydiving posture previously reported for highly arboreal anurans. Some snakes, in the genera Thamnophis and Elaphe, which typically thrashed and rolled in mug, managed to knot their own bodies with their tails and immediately became quiescent. This suggests that these reptiles gave stable physical contact, which would indicate that they were not falling, primacy over vestibular input that indicated that they were in freefall. The fact that they became quiet upon self-embrace further suggests a failure to distinguish self from non-self. The patterns of behavior seen in amphibians and reptiles in mug can be explained in light of their normal ecology and taxonomic relations.
Descriptors: various species of reptiles and amphibians, gravity perception, physiology, hypogravity, motor activity, microgravity (mug), behavioral reactions.

Wassif, E.T. (2002). **Ultrastructure of the lingual epithelium of adult scincine lizard *Chalcides ocellatus*.** *Egyptian Journal of Biology* 4: 76-86. ISSN: 1110-6859.
Online: http://www.nottingham.ac.uk/%7Eplzfg/EBBSoc/ejb4/Wassif_2002.pdf
Descriptors: adult scincine reptiles, lizard, *Chalcides ocellatus*, lingual epithelium, adult, ultrastructure.

Weber, A.E., J. Martin, and M. Ariel (2003). **Connectivity of the turtle accessory optic system.** *Brain Research* 989(1): 76-90. ISSN: 0006-8993.
Descriptors: reptiles, turtle, accessory optic system, connectivity, synaptic inputs, pond turtle, neurons, afferent, efferent, connections.

Weiss, S.L. and M.C. Moore (2004). **Activation of aggressive behavior by progesterone and testosterone in male tree lizards, *Urosaurus ornatus*.** *General and Comparative Endocrinology* 136(2): 282-288. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: Testosterone is usually thought to be the major sex steroid regulating adult male territorial aggression in vertebrates. However, recent evidence has suggested a role for progesterone, as well as testosterone, in the organization of the two male reproductive phenotypes of tree lizards (*Urosaurus ornatus*), which differ in adult levels of territorial behavior. In the present experiment we tested whether progesterone and testosterone could also play an activational role in the expression of adult aggressive behavior. We subjected post-reproductive male tree lizards to the following treatments: sham surgery, castration, castration with progesterone supplementation, and castration with testosterone supplementation. We measured several different dimensions of aggressive behavior. Overall in these post-reproductive animals, the level of aggression from lowest to highest was: castrates, shams, progesterone-treated, and testosterone-treated. Although testosterone appears to be the more potent regulator of aggressive behavior, progesterone enhanced several measures of aggression suggesting that it could play a role in natural regulation of aggressive behavior. This initial study used very high levels of progesterone (similar to or above those experienced by hatchlings) to maximize the probability of detecting an effect. Further studies are needed to determine if natural adult progesterone levels are sufficiently high to influence aggressive behavior.
Descriptors: reptiles, male tree lizards, *Urosaurus ornatus*, aggressive behavior, activation, testosterone, progesterone.

Westhoff, G., B.G. Fry, and H. Bleckmann (2005). **Sea snakes (*Lapemis curtus*) are sensitive to low-amplitude water motions.** *Zoology [Jena]* 108(3): 195-200. ISSN: 0944-2006.
NAL Call Number: QL1.Z769
Abstract: The sea snake *Lapemis curtus* is a piscivorous predator that hunts at dusk. Like land snakes, sea snakes have scale sensillae that may be mechanoreceptive, i.e. that may be useful for the detection of water motions produced by prey fish. In addition, inner ear hair cells of sea snakes may also be involved in the detection of hydrodynamic stimuli. We generated water motions and pressure fluctuations with a vibrating sphere. In the test range 50-200 Hz evoked potentials were recorded from the midbrain of *L. curtus* in response to vibrating sphere stimuli. In terms of water displacement the lowest threshold amplitudes

were in the frequency range 100-150 Hz. In this range peak-to-peak water displacement amplitudes of 1.8 microm (at 100 Hz) and 2.0 microm (150 Hz) generated a neural response in the most sensitive animal. Although this low sensitivity may be sufficient for the detection of fish-generated water motions, it makes it unlikely that *L. curtus* has a special hydrodynamic sense.
Descriptors: sea snakes, *Lapemis curtus*, sensitive, low amplitude warer motuion, somatosensory physiology, motion perception, physiology, water movements, electric stimulation, pressure.

Wilson, K.A., P.M. Cavanagh, and J. Willepique (2003). **Radiotransmitter attachment technique for box turtles (*Terrapene* spp.).** *Chelonian Conservation and Biology* 4(3): 688-691. ISSN: 1071-8443.
Descriptors: reptiles, box turtles, radiotransmitter attachment, technique, *Terrapene* spp.

Winne, C.T., J.D. Willson, K.M. Andrews, and R.N. Reed (2006). **Efficacy of marking snakes with disposable medical cautery units.** *Herpetological Review* 37(1): 52-54. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, snakes, marking, disposable medical cautery units, efficacy.

Woolley, S.C., J.T. Sakata, and D. Crews (2004). **Tracing the evolution of brain and behavior using two related species of whiptail lizards: *Cnemidophorus uniparens* and *Cnemidophorus inornatus.*** *ILAR Journal* 45(1): 46-53. ISSN: 1084-2020.
Online: http://dels.nas.edu/ilar_n/ilarjournal/45_1/html/v4501woolley.shtml
NAL Call Number: QL55.A1I43
Descriptors: reptiles, whiptail lizards, *Cnemidophorus uniparens*, *Cnemidophorus inornatus*, laboratory animals, animal models, females, parthenogenesis, triploidy, diploidy, dopamine, hormone receptors, literature reviews.

Wu, G.Y., J.F. Liao, and Z.X. Tang (2006). **Cellularity and fiber linking of cortical layer of reptile.** *Sichuan Journal of Zoology* 25(2): 416-419. ISSN: 1000-7083.
Descriptors: reptiles, cortical layer, cellularity, fiber linking, research.
Language of Text: Chinese; Summary in Chinese.

Wu, H.X. (2004). **Identification and inhibitory effects of drugs against pathogenic bacteria of soft-shelled turtle (*Trionyx sinensis*) in vitro.** *Fisheries Science Liaoning* 23(6): 5-9. ISSN: 1003-1111.
Descriptors: reptiles, soft shelled turtle, *Trionyx sinensis*, pathogenic bacteria, drugs against, inhibitory effects, identification.
Language of Text: Chinese; Summary in Chinese and English.

Yeh, C.I. and A.S. Powers (2005). **Effects of blocking nitric oxide on learning in turtles (*Chrysemys picta*).** *Behavioral Neuroscience* 119(6): 1656-1661. ISSN: 0735-7044.
NAL Call Number: QP351.B45
Descriptors: turtles, *Chrysemys picta*, learning, nitric oxide, blocking, effects.

Zhang, S.Z., X.B. Wu, and B.H. Chen (2003). **General situation of study on histology and cytology of digestive system of *Alligator sinensis*.** *Sichuan Journal of Zoology* 22(2): 76-79. ISSN: 1000-7083.
Descriptors: reptiles, alligator, *Alligator sinensis*, digestive system, cytology, histology, study, general situation.
Language of Text: Chinese; Summary in Chinese and English.

Zheng, J.F. and M.Y. Zhu (2005). **Construction and characterization of a cDNA library from kidney/ urogenital complex tissues of one-week-old embryos of the softshelled turtle *Trionyx sinensis*.** *Acta Zoologica Sinica* 51(6): 1156-1161. ISSN: 0001-7302.
Descriptors: reptiles, softshelled turtle, *Trionyx sinensis*, construction, cDNA library, kidney, urogenital tissue complex.
Language of Text: Chinese.

Zhou, L., C. Yang, and L. Xiao (2003). **PCR-mediated recombination between *Cryptosporidium* spp. of lizards and snakes.** *Journal of Eukaryotic Microbiology* 50(Suppl.): 563-565. ISSN: 1066-5234.
Abstract: The presence or absence of genetic recombination has often been used as one of the criteria for *Cryptosporidium* species designation and population structure delineation. During a recent study of cryptosporidiosis in reptiles that were housed in the same room, 4 lizards were found to have concurrent infections of *C. serpentis* (a gastric parasite) and *C. saurophilum* (an intestinal parasite), and 6 snakes were concurrently infected with *C. serpentis, C. saurophilum* and a new *Cryptosporidium* as indicated by PCR-RFLP analysis of the SSU rRNA gene. DNA sequence analysis of cloned PCR products confirmed the diagnosis of mixed infections. Surprisingly, it appeared that 11 of the 22 clones (8 and 14 clones from a lizard and a snake, respectively) had chimeric sequences of two *Cryptosporidium* spp. BootScan analysis indicated the existence of recombinants among the cloned sequences and detection of the informative sites confirmed the BootScan results. Because the probability for genetic recombination between gastric and intestinal parasites is small, these hybrid sequences were likely results of PCR artifacts due to the presence of multiple templates. This was confirmed by PCR-sequencing analysis of single-copy templates using diluted DNA samples. Direct sequencing of 69 PCR products from 100- to 1,000-fold diluted DNAs from the same snake and lizard produced only sequences of *C. serpentis, C. saurophilum* and the unnamed *Cryptosporidium* sp. Thus, care should be taken to eliminate PCR artifacts when determining the presence of genetic recombination or interpreting results of population genetic studies.
Descriptors: reptiles, lizards, snakes, *Cryptosporidium*, PCR, mediated recombination, genetic rcombination, boot scans, PCR sequencing, captive animals.

Zhu, D. and J. Keifer (2005). **Distribution of facial motor neurons in the pond turtle *Pseudemys scripta elegans*.** *Neuroscience Letters* 373(2): 134-137. ISSN: 0304-3940.
Abstract: A tract tracing study was performed to examine the localization of the facial nucleus in the brain stem of the pond turtle, *Pseudemys scripta elegans*. Neurobiotin and the fluorescent tracers alexa fluor 488 and 594 were used to retrogradely label neurons of the

abducens or facial nerves. The results showed that the facial nucleus has two subnuclei, a medial group and a lateral group. Measurements of cell size revealed no significant differences between these populations. Double labeling studies showed that the medial cell group of the facial nucleus lies between the principal and accessory abducens nuclei in the pons, whereas the lateral group lies adjacent to the accessory abducens nucleus. The facial nucleus of pond turtles largely overlaps the rostrocaudal extent of the accessory abducens nucleus, but extends well beyond it into the medulla. These data elucidate the position and distribution of the facial nucleus in the brain stem of pond turtles and contribute to the body of comparative neuroanatomical literature on the distribution of the cranial nerve nuclei of reptiles.
Descriptors: pond turtle, *Pseudemys scripta elegans*, facial nerve, cytology, motor neurons, neural pathways, turtles anatomy, histology.

Zotti, A., P. Selleri, P. Carnier, M. Morgante, and D. Bernardini (2004). **Relationship between metabolic bone disease and bone mineral density measured by dual-energy X-ray absorptiometry in the green iguana (*Iguana iguana*).** *Veterinary Radiology and Ultrasound* 45(1): 10-16. ISSN: 1058-8183.
NAL Call Number: SF757.8.A4
Abstract: The aim of our work was to study the feasibility of using dual-energy X-ray absorptiometry to obtain reference bone density values in relation to body weight, gender, and metabolic bone disease in the green iguana. The study was performed on 28 animals. The weight, age, and gender of each iguana were recorded. Each lizard was carefully examined and radiographed to detect signs of metabolic bone disease. Blood samples were collected from each animal to evaluate Ca/P and total protein. All animals, both affected (group B; n = 11) and unaffected (group A; n = 17) by metabolic bone disease, were individually scanned using an X-ray densitometer. The regions of interest were the head, lumbar spine, right, and left femur. Statistical analysis was performed separately for each region of interest. Body weight had the strongest relationship with bone density ($P < 0.01$). Within regions of interest, for iguanas of average weight (710 g), statistically significant differences between healthy and sick animals were found: head (0.140 vs. 0.090 g/cm2; $P < 0.01$); lumbar spine (0.164 vs. 0.107 g/cm2; $P < 0.01$); right femur (0.103 vs. 0.076 g/cm2; $P < 0.01$); left femur (0.103 vs. 0.078 g/cm2; $P < 0.01$). Regression equations to obtain reference values of bone density as a function of body weight for animals affected and not affected by metabolic bone disease are provided. Our data indicate that X-ray bone densitometry is an additional tool for studying bone pathophysiology in reptiles.
Descriptors: reptiles, iguana, metabolic bone disease, bone mineral density, relationship, duel-energy X-ray absorptiometry, body weight.

Stress and Well-being

Bobb, V.T. and D.C. Jackson (2005). **Effect of graded hypoxic and acidotic stress on contractile force of heart muscle from hypoxia-tolerant and hypoxia-intolerant turtles.** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 303(5): 345-353. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Descriptors: turtles, hypoxic, acidotic, stress, heart muscle, contractile force, hypoxia tolerant, intolerant, effect.

Cree, A., C.L. Tyrrell, M.R. Preest, D. Thorburn, and L.J. Guillette (2003). **Protecting embryos from stress: corticosterone effects and the corticosterone response to capture and confinement during pregnancy in a live-bearing lizard (*Hoplodactylus maculatus*).** *General and Comparative Endocrinology* 134(3): 316-329. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: Hormones in the embryonic environment, including those of the hypothalamo-pituitary-adrenal (HPA) axis, have profound effects on development in eutherian mammals. However, little is known about their effects in reptiles that have independently evolved viviparity. We investigated whether exogenous corticosterone affected embryonic development in the viviparous gecko *Hoplodactylus maculatus*, and whether pregnant geckos have a corticosterone response to capture and confinement that is suppressed relative to that in non-pregnant (vitellogenic) females and males. Corticosterone implants (5 mg, slow-release) administered to females in mid-pregnancy caused a large elevation of corticosterone in maternal plasma (P<0.001), probable reductions in embryonic growth and development (P=0.069-0.073), developmental abnormalities and eventual abortions. Cool temperature produced similar reductions in embryonic growth and development (P< or =0.036 cf. warm controls), but pregnancies were eventually successful. Despite the potentially harmful effects of elevated plasma corticosterone, pregnant females did not suppress their corticosterone response to capture and confinement relative to vitellogenic females, and both groups of females had higher responses than males. Future research should address whether lower maternal doses of corticosterone produce non-lethal effects on development that could contribute to phenotypic plasticity. Corticosterone implants also led to increased basking in pregnant females (P<0.001), and basal corticosterone in wild geckos (independent of reproductive condition) was positively correlated with body temperature (P<0.001). Interactions between temperature and corticosterone may have broad significance to other terrestrial ectotherms, and body temperature should be considered as a variable influencing plasma corticosterone concentrations in all future studies on reptiles.
Descriptors: reptiles, lizard, gecko, embryo stress, protecting, corticosterone, effects, response, capture, confinement, pregnancy.

DeNardo, D.F. (2004). **Stress and its influence on clinical disease in reptiles**. *Proceedings of the North American Veterinary Conference* 18: 1326-1328. ISSN: 0341-6953.
NAL Call Number: SF605.N672
Descriptors: reptiles, stress, influence on clinical disease , restraint.
Notes: In the volume: Small Animal and Exotics Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Franklin, C.E., B.M. Davis, S.K. Peucker, H. Stephenson, R. Mayer, J. Whittier, J. Lever, and G.C. Grigg (2003). **Comparison of stress induced by manual restraint and immobilisation in the estuarine crocodile, *Crocodylus porosus*.** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 298(2): 86-92. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Descriptors: reptiles, estuarine crocodile , *Crocodylus porosus*, stress, manual restraint, immobilization, electrostunning, comparison, handling methods.

French, S.S., K.S. Matt, and M.C. Moore (2006). **The effects of stress on wound healing in male tree lizards (*Urosaurus ornatus*).** *General and Comparative Endocrinology* 145(2): 128-132. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: Exposure to stress can affect an organism's partitioning of resources among immune function and other organismal functions. However, measuring immune function is often difficult. Recent studies show that the rate of cutaneous wound healing in laboratory rodents is a simple, integrated measure of stress-sensitive immune function. We investigated the use of this technique in tree lizards to test the hypotheses (1) that stress compromises wound healing and (2) that this effect is at least partially mediated by corticosterone. Laboratory-housed male tree lizards randomly assigned to the experimental and control treatment groups received a 3.5 mm cutaneous biopsy on the dorsal surface of the pelvis. Experimental group males were restrained in cloth bags for 60 min every day for 21 days during the healing profile, whereas control males were left in their cages. Wound sizes were measured every other day by image analysis. Control animals healed faster than stressed animals. The difference in wound surface area between the groups was most pronounced early in the healing profile. Stressed animals also had higher corticosterone levels and corticosterone was negatively correlated with healing rate in the stressed animals. These observations support both hypotheses that stress compromises healing and that corticosterone may act to mediate the effects of stress.
Descriptors: tree lizards, *Urosaurus ornatus*, corticosterone blood, lizards physiology, stress blood, wound healing physiology, restraint, physical, stress immunology.

Ganesh, C.B. and H.N. Yajurvedi (2002). **Stress inhibits seasonal and FSH-induced ovarian recrudescence in the lizard, *Mabuya carinata*.** *Journal of Experimental Zoology.* 292(7): 640-648. ISSN: print: 0022-104X; online: 1097-010X.
NAL Call Number: 410 J825
Descriptors: reptiles, lizard, *Mabuya carinata*, stress, inhibits, FSH induced, ovarian recrudescence.

Harms, C.A., K.M. Mallo, P.M. Ross, and A. Segars (2003). **Venous blood gases and lactates of wild loggerhead sea turtles (*Caretta caretta*) following two capture techniques.** *Journal of Wildlife Diseases* 39(2): 366-374. ISSN: 0090-3558.

NAL Call Number: 41.9 W64B

Abstract: During summer of 2001, venous blood gases were determined in loggerhead sea turtles (*Caretta caretta*) captured by trawl (n = 16) in coastal waters of South Carolina and Georgia (USA) as part of a sea turtle census program and captured in pound nets (n = 6) in coastal North Carolina (USA) during a study of sea turtle population biology. Trawls were towed for 30 min, so turtles captured were forcibly submerged for < or = 30 min. Pound nets are passive gear in which fish and sea turtles are funneled into a concentrated area and removed periodically. Sea turtles in pound nets are free to surface and to feed at will. Blood was obtained from the dorsal cervical sinus as quickly as possible after landing on the boat (range 2-10 min trawl, 1-2 min pound net) and at 30 min after landing just prior to release. Blood gases including pH, partial pressures of O2 and CO2 (pO2, pCO2), and lactate were measured within 10 min. Instrument measurements for pH, pO2, and pCO2 made at 37 C were corrected to cloacal temperature and HCO3- was calculated from temperature-corrected pH and pCO2. Venous blood pH and bicarbonate were higher, and pO2 and lactate were lower from pound net-captured turtles compared to trawl captured turtles at the initial sampling time. In pound net turtles, pH and bicarbonate declined and lactate increased during 30 min on deck. In trawled sea turtles, venous blood pH increased and pCO2 and pO2 decreased during the 30 min on deck. Both capture systems caused perturbations in blood gas, acid-base, and lactate status, though alterations were greater in trawl captured turtles.

Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, wild, capture techniques, venous blood gases, lactates, acid-base.

Jessop, T.S., J.M. Sumner, C.J. Limpus, and J.M. Whittier (2004). **Interplay between plasma hormone profiles, sex and body condition in immature hawksbill turtles (*Eretmochelys imbricata*) subjected to a capture stress protocol.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 137(1): 197-204. ISSN: 1095-6433.

Abstract: We investigated plasma hormone profiles of corticosterone and testosterone in immature hawksbill turtles (*Eretmochelys imbricata*) in response to a capture stress protocol. Further, we examined whether sex and body condition were covariates associated with variation in the adrenocortical response of immature turtles. Hawksbill turtles responded to the capture stress protocol by significantly increasing plasma levels of corticosterone over a 5 h period. There was no significant sex difference in the corticosterone stress response of immature turtles. Plasma testosterone profiles, while significantly different between the sexes, did not exhibit a significant change during the 5 h capture stress protocol. An index of body condition was not significantly associated with a turtle's capacity to produce plasma corticosterone both prior to and during exposure to the capture stress protocol. In summary, while immature hawksbill turtles exhibited an adrenocortical response to a capture stress protocol, neither their sex nor body condition was responsible for variation in endocrine responses. This lack of interaction between the adrenocortical response and these internal factors suggests that the inactive reproductive- and the current energetic- status of these immature

turtles are important factors that could influence plasma hormone profiles during stress.
Descriptors: reptiles, immature hawksbill turtle, *Eretmochelys imbricata*, capture stress protocol, interplay, plasma hormone profiles, sex and body condition.

Lance, V.A., R.M. Elsey, G. Butterstein, and P.L.I. Trosclair (2004). **Rapid suppression of testosterone secretion after capture in male American alligators (*Alligator mississippiensis*).** *General and Comparative Endocrinology* 135(2): 217-222. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: reptiles, alligator, *Alligator mississippiensis*, capture, stress, testosterone suppression, corticosterone increase.

Langkilde, T. and R. Shine (2006). **How much stress do researchers inflict on their study animals? A case study using a scincid lizard, *Eulamprus heatwolei*.** *Journal of Experimental Biology.* 209(Pt 6): 1035-1043. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.02112
NAL Call Number: 442.8 B77
Abstract: Research on live vertebrates is regulated by ethics committees, who prohibit ;excessively stressful' procedures. That judgment is based on intuition - a notoriously unreliable criterion when dealing with animals phylogenetically distant from humans. To objectively evaluate the stress imposed by research practices, we measured plasma corticosterone levels in lizards (*Eulamprus heatwolei* Wells & Wellington, Scincidae). Some procedures (handling and measuring, toe-clipping for identification, exposure to predator scent) did not induce significant increases in corticosterone levels, suggesting that these stimuli generated relatively little stress. However, other stimuli (testing locomotor speed, microchip implantation, blood sampling, an unfamiliar enclosure, tail autotomy, exposure to a heterospecific lizard) were more stressful, with corticosterone levels increasing only transiently in some treatments (<2 h for tail autotomy), but persisting much longer in others (14 days for microchip implantation). Overall, our data suggest that the levels of stress induced by routine laboratory procedures are no greater than those often experienced by lizards in nature; but that intuition provides a poor basis for evaluating the levels of stress induced by research. For example, toe-clipping is often criticized and sometimes banned; but our data suggest that this method is actually less stressful than the technique frequently recommended to replace it on ethical grounds (microchip implantation). Toe-clipping also was less stressful than superficially trivial manipulations such as housing the animal in an unfamiliar enclosure. More generally, we urge researchers to seek objective information on the effects of their activities on research subjects, rather than relying upon subjectivity and anthropomorphism in making these evaluations.
Descriptors: lizards (*Eulamprus heatwolei*) laboratory, corticosterone blood, lizards physiology, stress, psychological etiology, acclimatization, lizard husbandry methods, lizardl husbandry standards, handling psychology.

Lutterschmidt, D.I. and R.T. Mason (2005). **A serotonin receptor antagonist, but not melatonin, modulates hormonal responses to capture stress in two populations of garter snakes (*Thamnophis sirtalis parietalis* and *Thamnophis sirtalis concinnus*).** *General and Comparative Endocrinology* 141(3): 259-270. ISSN: 0016-6480.

NAL Call Number: 444.8 G28

Abstract: Hormonal and behavioral responses to a stressor depend on many factors, including the influence of other hormones. We examined the role of melatonin in modulating hormonal responses to capture stress in two populations of male garter snakes, *Thamnophis sirtalis*. Studies of red-sided (*T. sirtalis parietalis*) and red-spotted (*T. sirtalis concinnus*) garter snakes were conducted in the field with free-living snakes. Populations of red-sided garter snakes in south-central Manitoba, Canada undergo a period of winter dormancy for approximately 8 months each year followed by an attenuated mating season (4-5 weeks) in early spring. In contrast, the mid-latitude red-spotted garter snake in western Oregon, USA has an extended breeding season and can be active during 10-12 months of the year given appropriate environmental conditions. We chose to study these two populations of garter snakes to investigate possible variation in melatonin function among snakes with different suites of environmental adaptations. To better address these questions, we also examined the effects of 5-hydroxytryptophan (a precursor of melatonin synthesis) and ketanserin (a serotonergic type 2A receptor antagonist) on hormonal responses to capture stress. We observed a trend of increased corticosterone and decreased androgen concentrations in northern-latitude red-sided garter snakes (*T. sirtalis parietalis*) subjected to 4 h of capture stress during the spring. However, these differences were not statistically significant. During the fall, red-sided garter snakes showed no change in corticosterone or androgen concentrations in response to the capture stress treatments. We speculate that northern-latitude red-sided garter snakes suppress hormonal responses to capture stress during preparation for winter dormancy. Treatment with melatonin, 5-hydroxytryptophan, or ketanserin did not significantly influence corticosterone or androgen concentrations of northern-latitude red-sided garter snakes during the spring or fall. Mid-latitude red-spotted garter snakes (*T. sirtalis concinnus*) from Oregon showed a statistically significant increase in corticosterone concentrations in response to 4 h of capture stress; treatment with melatonin, 5-hydroxytryptophan, or ketanserin prior to capture stress had no significant influence on plasma corticosterone concentrations. Androgen concentrations of mid-latitude red-spotted garter snakes in response to capture stress were significantly lower than those of non-stressed control snakes. Neither melatonin nor 5-hydroxytryptophan influenced the change in androgen concentrations during capture stress. However, androgen concentrations of snakes treated with ketanserin prior to 4 h of capture stress did not differ significantly from those of non-stressed control snakes. These studies suggest that melatonin does not modulate hormonal responses to capture stress in this ectothermic model. Our results also suggest that a serotonin-regulated system may play a role in modulating the activity of the hypothalamic-pituitary-gonadal axis during physiological stress responses.

Descriptors: garter snakes, *Thamnophis sirtalis parietalis* and *Thamnophis sirtalis concinnus*, capture stress, serotonin receptor antagonist, melatonin, hormonal response, modulates, stressor, behavioral response.

McMann, S. and A.V. Paterson (2003). **Effects of capture, observer presence, and captivity on display behavior in a lizard.** *Journal of Herpetology* 37(3): 538-540. ISSN: 0022-1511.

NAL Call Number: QL640.J6

Descriptors: reptiles, lizard, behavior, captivity, display, observer presence, capture, effects.

Woodley, S.K. and M.C. Moore (2002). **Plasma corticosterone response to an acute stressor varies according to reproductive condition in female tree lizards (*Urosaurus ornatus*).** *General and Comparative Endocrinology* 128(2): 143-148. ISSN: 0016-6480.

NAL Call Number: 444.8 G28

Abstract: The magnitude of the glucocorticoid response to a stressor can depend on both environmental and physiological context. One factor that has not been examined is whether females of different reproductive states have different responses to a stressor. We examined whether corticosterone (CORT) increased after a 10 min handling stress in oviparous female tree lizards (*Urosaurus ornatus*) that were vitellogenic (yolking follicles) or gravid (post-ovulatory). We found that stressed vitellogenic females had a large increase in plasma CORT whereas gravid females did not. Baseline levels of CORT in gravid females were relatively high and similar to those in stressed vitellogenic females. The lack of a stress response in gravid females may be due to an inability to secrete higher levels of CORT or a suppression of the stress response. In addition, within vitellogenic females, CORT was positively correlated with ovarian weight, suggesting that CORT may function in some aspect of ovarian development during vitellogenesis.

Descriptors: reptiles, female tree lizards, *Urosaurus ornatus*, plasma corticosterone response, acute stressor, reproductive condition.

Yajurvedi, H.N. and S. Menon (2005). **Influence of stress on gonadotrophin induced testicular recrudescence in the lizard *Mabuya Carinata*.** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 303(7): 534-540. ISSN: print: 1548-8969; online: 1552-499X.

NAL Call Number: QL1.J854

Abstract: Administration (ip) of FSH (10 IU/0.1 ml distilled water (dw)/lizard/alternate days/30 days) to adult male lizards, *Mabuya carinata*, during the early recrudescence phase of the reproductive cycle caused activation of spermatogenic and steroidogenic activity of the testis, as shown by a significant increase in mean number of spermatogonia, primary spermatocytes and spermatids, and serum levels of testosterone, as compared to initial controls. In addition, there were abundant spermatozoa in the lumen of the seminiferous tubules. Interestingly, administration of a similar dosage of FSH to lizards exposed to stressors (handling, chasing, and noise randomly applied, five times a day for 30 days) resulted in a significant increase in mean number of spermatogonia and primary spermatocytes over initial control values, whereas the number of secondary spermatocytes and spermatids and serum levels of testosterone did not significantly differ from those of initial controls, and were significantly lower than FSH treated normal lizards. Further, spermatozoa were infrequently found in the seminiferous tubules of these lizards. Treatment controls (receiving 0.1 ml dw/lizard/alternate days for 30 days) did not show significant variation in mean number of spermatogonia, spermatocytes and spermatids, and serum levels of testosterone from initial controls. Another group of lizards was exposed to stressors and did not receive FSH. These lizards showed a significant decrease in mean number of secondary spermatocytes compared to treatment controls and all other parameters did not significantly differ from those of both control groups. The results reveal that gonadotrophin-induced spermatogonial proliferation occurs under stressful conditions, whereas progress of spermatogenesis beyond primary spermatocyte stage

is impaired due to inhibition (under stress) of gonadotrophin induced steroidogenic activity in *M. carinata*.

Descriptors: lizard, *Mabuya carinata*, stress, influence, gonadotrophin, induced testicular recrudescence, reproductive cycle, distilled water, testosterone, serum levels.

Zhou, X., C. Niu, and R. Sun (2004). **The effects of vitamin E on antiacid stress ability in juvenile soft-shelled turtles (*Pelodiscus sinensis*).** *Comparative Biochemistry and Physiology. Part C Toxicology and Pharmacology* 137(4): 299-305. ISSN: 1532-0456.

Abstract: We determined the effect of dietary supplementation with vitamin E (0-, 50-, 250-, 500-, 1000- and 5000-mg/kg diet for 4 weeks) on antistress ability in juvenile soft-shelled turtle (*Pelodiscus sinensis*). Half of the turtles per dose group were treated by acid stress for 24 h. The results showed that phagocytosis of blood cells in the control group significantly decreased after acid stress while the other five groups had no significant changes compared with those of before stress. Serum bacteriolytic activity in the control group and the group supplemented with 50-mg vitamin E/kg diet significantly decreased after acid stress. The other four groups showed no significant differences compared with those before stress. Serum bactericidal activities in all groups notably decreased after acid stress, but the difference of serum bactericidal activity in before and after stress had a decreased tendency from the control group to the highest dose group. Serum cortisol levels in the control group were significantly increased while the other five groups had no notable increases after acid stress. Liver vitamin E levels in all groups had no notable changes compared with those before stress but there was a tendency to decrease after acid stress. These results suggest that acid stress depress immune function and increase serum cortisol levels in turtles while vitamin E alleviate the adverse effects caused by acid stress.

Descriptors: reptiles, soft-shelled turtles, *Pelodiscus sinensis*, antacid stress ability, vitamine E, effects, juvenile, dietary supplementation, immune function.

Zhou, X.Q., C.J. Niu, and R.Y. Sun (2005). **The effect of vitamin C on stress withstanding capability in the juvenile soft-shelled turtle (*Pelodiscus sinensis*).** *Aquaculture Nutrition* 11(3): 169-174. ISSN: 1353-5773.

NAL Call Number: SH156.A658

Descriptors: reptiles, turtle culture, soft-shelled turtle, *Pelodiscus sinensis*, juveniles, ascorbic acid, dietary supplements, erythrocytes, phagocytosis, animal stress, pH, water quality, blood serum, *Vibrio parahaemolyticus* , antimicrobial agents, disease control, *Pelodiscus sinensis*, acid stress.

Thermal and Temperature

Anderson, N.L., T.E. Hetherington, B. Coupe, G. Perry, J.B. Williams, and J. Lehman (2005). **Thermoregulation in a nocturnal, tropical, arboreal snake.** *Journal of Herpetology* 39(1): 82-90. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: reptiles, arboreal snake, nocturnal, tropical, thermoregulation, *Boiga irregularis* , brown tree snakes.

Angilletta, M.J.J., V. Lee, and A.C. Silva (2006). **Energetics of lizard embryos are not canalized by thermal acclimation.** *Physiological and Biochemical Zoology* 79(3): 573-580. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: In some species of ectotherms, temperature has little or no effect on the amount of energy expended during embryonic development. This phenomenon can result from either of two mechanisms: (1) a shorter incubation period at higher temperatures, which offsets the expected increase in metabolic rate, or (2) a compensatory decrease in the rate at which embryos expend energy for maintenance. To distinguish the relative importance of these two mechanisms, we quantified the acute and chronic effects of temperature on embryonic metabolism in the eastern fence lizard (*Sceloporus undulatus*). First, we measured metabolic rates of individual embryos at 27 degrees, 31 degrees, and 34 degrees C. Second, we examined the capacity for thermal acclimation by measuring the metabolic rates of embryos at 30 degrees C, after a period of incubation at either 28 degrees or 32 degrees C. As with adult reptiles, the metabolic rates of embryos increased with an acute increase in temperature; the Q(10) of metabolic rate from 27 degrees to 34 degrees C was 2.1 (+/-0.2). No evidence of thermal acclimation was observed either early or late in development. In *S. undulatus*, a shorter incubation period at higher temperatures appears to play the primary role in canalizing the energy budget of an embryo, but a reduction in the cost of growth could play a secondary role.
Descriptors: lizards, acclimatization physiology, embryonic development physiology, lizards embryology, lizards physiology, basal metabolism physiology, embryo, non-mammalian physiology, oviparity physiology, temperature.

Blouin Demers, G. and P. Nadeau (2005). **The cost-benefit model of thermoregulation does not predict lizard thermoregulatory behavior.** *Ecology* 86(3): 560-566. ISSN: 0012-9658.
Descriptors: reptiles, lizard, thermoregulation, thermoregulatory behavior, cost benefit model, temperature.

Booth, D.T. (2006). **Influence of incubation temperature on hatchling phenotype in reptiles.** *Physiological and Biochemical Zoology* 79(2): 274-281. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Incubation temperature influences hatchling phenotypes such as sex, size, shape,

color, behavior, and locomotor performance in many reptiles, and there is growing concern that global warming might adversely affect reptile populations by altering frequencies of hatchling phenotypes. Here I overview a recent theoretical model used to predict hatchling sex of reptiles with temperature-dependent sex determination. This model predicts that sex ratios will be fairly robust to moderate global warming as long as eggs experience substantial daily cyclic fluctuations in incubation temperatures so that embryos are exposed to temperatures that inhibit embryonic development for part of the day. I also review studies that examine the influence of incubation temperature on posthatch locomotion performance and growth because these are the traits that are likely to have the greatest effect on hatchling fitness. The majority of these studies used artificial constant-temperature incubation, but some have addressed fluctuating incubation temperature regimes. Although the number of studies is small, it appears that fluctuating temperatures may enhance hatchling locomotor performance. This finding should not be surprising, given that the majority of natural reptile nests are relatively shallow and therefore experience daily fluctuations in incubation temperature.

Descriptors: reptiles, newborn anatomy, histology, growth, development, reptiles anatomy, histology, growth, development, temperature, physiology, greenhouse effect, ovum physiology.

Booth, D.T., E. Burgess, J. McCosker, and J.M. Lanyon (2005). **The influence of incubation temperature on post-hatching fitness characteristics of turtles.** In: *Animals and environments: Proceedings of the Third International Conference of Comparative Physiology and Biochemistry,August 7, 2004-August 13, 2004, KwaZulu-Natal, South Africa,* International Congress Series, 0531-5131, Elsevier: Amsterdam, p. 226-233. ISBN: 0444517634.

NAL Call Number: QP82 .I58 2004

Descriptors: reptiles, turtles, incubation temperature, post hatching fitness, development.

Bostrom, B.L. and D.R. Jones (2007). **Exercise warms adult leatherback turtles.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 147(2): 323-331. ISSN: 1095-6433.

Abstract: Leatherback sea turtles (*Dermochelys coriacea*) can maintain body temperature (T(B)) up to 18 degrees C above that of the surrounding sea water (T(W)) which allows leatherbacks to enter cold temperate waters and have the largest global range of any reptile. Using a cylindrical model of a leatherback we investigated the extent to which heat production through variation of swim speed could be used in a leatherback's thermal strategy. Drag force of a full scale cast of a leatherback was measured in a low velocity wind tunnel to obtain an estimate of the metabolic cost needed to offset drag. Heat released in the core of a turtle as a byproduct of the metabolic cost of locomotion is conducted from the core of the turtle to the surrounding water through its insulation layer. By keeping insulation thickness constant, we highlight the effectiveness of swim speed in maintaining T(B)-T(W). Our model, when tested against published data at a given T(W), showed a close correlation between predicted and measured swimming speed at a given T(B). We conclude that the ability to maintain a large T(B)-T(W) is an interplay between mass, insulation thickness and water temperature selection but behavioural control of swimming speed predominates.

Descriptors: reptiles, leatherback sea turtles, body temperature, maintain, swim speed, drag force, body insulation thickness.

Bradshaw, D., M. Ladyman, and T. Stewart (2007). **Effect of hypernatraemia and the neurohypophysial peptide, arginine vasotocin (AVT) on behavioural thermoregulation in the agamid lizard, *Ctenophorus ornatus.*** *General and Comparative Endocrinology* 150(1): 34-40. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: Hypernatraemia induced by chronic injections of sodium chloride provokes thermal depression in the agamid lizard, *Ctenophorus* (formerly Amphibolurus) *ornatus*, with a fall of two degrees Celsius in the mean body temperature selected behaviourally in a photothermal gradient. The placement of an electrolytic lesion in the base of the hypothalamus, designed to eliminate secretion of the neuropeptide arginine vasotocin (AVT), did not affect the lizards' thermoregulatory behaviour and their Preferred Body Temperature (PBT) was not significantly different from that of unoperated controls. Saline loading, however, did not induce thermal depression in these tract-operated individuals and their PBT was significantly higher than that of salt-loaded intact individuals. When AVT was injected into operated, salt-loaded, animals, however, thermal depression was observed, supporting the hypothesis that thermal depression brought about by hypernatraemia is mediated through the action of AVT. AVT similarly significantly depressed the PBT of injected intact individuals by 3.2 degrees C when compared with hydrated controls. Immunostaining for AVT confirmed that the lesions placed in the region of the median eminence virtually eliminated AVT located in the neurohypophysial tract, and the pars nervosa. This is the first report of an effect of this peptide on behavioural thermoregulation in a lizard.
Descriptors: reptiles, agamid lizard, hypernatrimia, effects, neurohpophysial peptide, arginine vasotocin, behavioral thermoregulation.

Chen, H.L. and X. Ji (2002). **The effects of thermal environments on duration of incubation, hatching success and hatchlings traits in a colubrid snake, *Rhabdophis tigrinus lateralis* (Boie).** *Acta Ecologica Sinica* 22(11): 1850-1858. ISSN: 1000-0933.
Descriptors: reptiles, colubrid snake, *Rhabdophis tigrinus lateralis*, thermal environments, effects. incubation duration, hatching success, hatching traits.
Language of Text: Chinese; Summary in Chinese and English.

Chiara Magnone, M., B. Jacobmeier, C. Bertolucci , A. Foa, and U. Albrecht (2005). **Circadian expression of the clock gene Per2 is altered in the ruin lizard (*Podarcis sicula*) when temperature changes.** *Brain Research. Molecular Brain Research* 133(2): 281-285. ISSN: 0169-328X.
Abstract: When exposed to the cold, the body temperature of the ruin lizard (*Podarcis sicula*), an ectothermic vertebrate, comes into equilibrium with that low environmental temperature. During this time, the behavioral output of the circadian clock, locomotor activity, disappears. We tested the activity of the circadian clockwork at low temperature (6 degrees C) by following the expression of one of its essential components, the Period2 (Per2) gene. Here we show that lizard Per2 (lPer2) expression, which is rhythmic and paralleling

the behavioral rhythm of locomotor activity at higher temperature (29 degrees C), becomes constantly high at low temperature. When lizards are re-exposed to high temperature, rhythmic lPer2 expression is re-established after 2 days of adaptation and coincides with onset of locomotor activity. The alteration of the lPer2 expression pattern at low temperature indicates that the activity of the molecular feedback loop is modified under these conditions.
Descriptors: lizard, *Podarcis sicula*, circadian rhythm, temperature, eye proteins genetics, RNA, biosynthesis, reverse transcriptase polymerase chain reaction methods.

Christian, K.A., C.R. Tracy, and C.R. Tracy (2006). **Evaluating thermoregulation in reptiles: An appropriate null model**. *American Naturalist* 168(3): 421-430. ISSN: 0003-0147.
NAL Call Number: 470 Am36
Descriptors: reptiles, thermoregulation, evaluating, null model, ectotherms, thermal inertia, body mass, warming, cooling.

Clark, T.D., P.J. Butler, and P.B. Frappell (2005). **Digestive state influences the heart rate hysteresis and rates of heat exchange in the varanid lizard *Varanus rosenbergi*.** *Journal of Experimental Biology* 208(Pt 12): 2269-2276. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01657
NAL Call Number: 442.8 B77
Abstract: To maximize the period where body temperature (Tb) exceeds ambient temperature (Ta), many reptiles have been reported to regulate heart rate (fH) and peripheral blood flow so that the rate of heat gain in a warming environment occurs more rapidly than the rate of heat loss in a cooling environment. It may be hypothesized that the rate of cooling, particularly at relatively cool Tbs, would be further reduced during postprandial periods when specific dynamic action (SDA) increases endogenous heat production (i.e. the heat increment of feeding). Furthermore, it may also be hypothesized that the increased perfusion of the gastrointestinal organs that occurs during digestion may limit peripheral blood flow and thus compromise the rate of heating. Finally, if the changes in fh are solely for the purpose of thermoregulation, there should be no associated changes in energy demand and, consequently, no hysteresis in the rate of oxygen consumption (V(O2)). To test these hypotheses, seven individual *Varanus rosenbergi* were heated and cooled between 19 degrees C and 35 degrees C following at least 8 days fasting and then approximately 25 h after consumption of a meal (mean 10% of fasted body mass). For a given Tb between the range of 19-35 degrees C, fh of fasting lizards was higher during heating than during cooling. Postprandial lizards also displayed a hysteresis in fh, although the magnitude was reduced in comparison with that of fasting lizards as a result of a higher fh during cooling in postprandial animals. Both for fasting and postprandial lizards, there was no hysteresis in V(O2) at any Tb throughout the range although, as a result of SDA, postprandial animals displayed a significantly higher V(O2) than fasting animals both during heating and during cooling at Tbs above 24 degrees C. The values of fh during heating at a given Tb were the same for fasting and postprandial animals, which, in combination with a slower rate of heating in postprandial animals, suggests that a prioritization of blood flow to the gastrointestinal organs during digestion is occurring at the expense of higher rates of heating. Additionally, postprandial lizards took longer to cool at Tbs below 23 degrees C, suggesting that the endogenous heat produced

during digestion temporarily enhances thermoregulatory ability at lower temperatures, which would presumably assist *V. rosenbergi* during cooler periods in the natural environment by augmenting temperature-dependent physiological processes.
Descriptors: lizard, *Varanus rosenbergi*, body temperature regulation, digestive system, gastrointestinal tract, blood supply, heart rate, postprandial period, body temperature , electrocardiography, oxygen consumption.

Clark, T.D., T. Wang, P.J. Butler, and P.B. Frappell (2005). **Factorial scopes of cardio-metabolic variables remain constant with changes in body temperature in the varanid lizard, *Varanus rosenbergi*.** *American Journal of Physiology. Regulatory, Integrative and Comparative Physiology* 288(4): R992-R997. ISSN: print: 0363-6119; online: 1522-1490.
Online: http://dx.doi.org/10.1152/ajpregu.00593.2004
Abstract: The majority of information concerning the cardio-metabolic performance of varanids during exercise is limited to a few species at their preferred body temperature (T(b)) even though, being ectotherms, varanids naturally experience rather large changes in T(b). Although it is well established that absolute aerobic scope declines with decreasing T(b), it is not known whether changes in cardiac output (V(b)) and/or tissue oxygen extraction, (Ca(O2) - Cv(O2)), are in proportion to the rate of oxygen consumption (Vo(2)). To test this, we studied six Rosenberg's goannas (Varanus rosenbergi) while at rest and while maximally exercising on a treadmill both at 25 and 36 degrees C. During maximum exercise both at 25 and 36 degrees C, mass-specific rate of oxygen consumption (Vo(2kg)) increased with an absolute scope of 8.5 ml min(-1) kg(-1) and 15.7 ml min(-1) kg(-1), respectively. Interestingly, the factorial aerobic scope was temperature-independent and remained at 7.0 which, at each T(b), was primarily the result of an increase in V(bkg), governed by approximate twofold increases both in heart rate (f(H)) and cardiac stroke volume (V(Skg)). Both at 25 degrees C and 36 degrees C, the increase in V(bkg) alone was not sufficient to provide all of the additional oxygen required to attain maximal Vo(2kg), as indicated by a decrease in the blood convection requirement V(bkg)/Vo(2kg); hence, there was a compensatory twofold increase in (Ca(O2) - Cv(O2)). Although associated with an increase in hemoglobin-oxygen affinity, a decrease in T(b) did not impair unloading of oxygen at the tissues and act to reduce (Ca(O2) - Cv(O2)); both Ca(O2)) and Cv(O2)) were maintained across T(b). The change in Vo(2kg) with T(b), therefore, is solely reliant on the thermal dependence of V(bkg). Maintaining a high factorial aerobic scope across a range of T(b) confers an advantage in that cooler animals can achieve higher absolute aerobic scopes and presumably improved aerobic performance than would otherwise be achievable.
Descriptors: varanid lizard, body temperature, physiology, hemodynamic processes, metabolism, blood gas analysis, cardiac output, exertion, heart rate, oxygen consumption, seasons, temperature.

Clusella Trullas, S., J.S. Terblanche, J.H. van Wyk, and J.R. Spotila (2007). **Low repeatability of preferred body temperature in four species of Cordylid lizards: Temporal variation and implications for adaptive significance.** *Evolutionary Ecology* 21(1): 63-79. ISSN: 0269-7653.
Abstract: Preferred body temperatures (T sel) of ectotherms are important for ecological and

evolutionary studies. In lizards, the measurement of T sel is controversial for several reasons, generally related to hypotheses addressing how T sel may evolve in the wild. Although seldom explicitly tested, evolutionary hypotheses of adaptation to local climate require that T sel meets the conditions of natural selection, which include repeatability, heritability and a link to fitness. Here, we investigated repeatability ((Sx(B, intra-class correlation coefficient) of T sel at several time-scales using four Cordylid species from heterogeneous thermal habitats. Although there was significant inter-individual variation within days (P < 0.005 in most cases), there was no significant inter-individual variation when calculated across several days (P > 0.05). Repeatability was low in all species investigated (from 0 to 0.482) when compared against other estimates of repeatability of T sel in the literature. Irrespective of how T sel was calculated, it showed inconsistent and variable temporal effects across species. Furthermore, repeatability of T sel did not change with acclimation to laboratory conditions. These data have implications for understanding the evolution of thermoregulation in these and other ectotherms.

Descriptors: reptiles, *Cordylus*, lizards, thermoregulation, coadaptation, inter individual variation, selection, temporal effects.

Costanzo, J.P., P.J. Baker, and R.E.J. Lee (2006). **Physiological responses to freezing in hatchlings of freeze-tolerant and -intolerant turtles.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 176(7): 697-707. ISSN: print: 0174-1578; online: 1432-136X.

NAL Call Number: QP33.J681

Abstract: Freeze tolerance is a complex cold-hardiness adaptation that has independently evolved in a diverse group of organisms, including several ectothermic vertebrates. Because little is known about the mechanistic basis for freeze tolerance in reptiles, we compared responses to experimental freezing in winter-acclimatized hatchlings representing nine taxa of temperate North American turtles, including ones that tolerated freezing and others that did not. Viability rates of hatchlings frozen to -3 degrees C for 72 h ranged from 0 to 100%. Tolerance to freezing was poor in *Sternotherus odoratus*, *Graptemys geographica* and *Trachemys scripta*, intermediate in *Chelydra serpentina*, and high in *Emydoidea blandingii*, *Chrysemys picta bellii*, *C. p. marginata*, *Malaclemys terrapin*, and *Terrapene ornata*, and generally reflected the winter thermal ecology of each taxon. Plasma activity of lactate dehydrogenase (LDH), a novel in vivo index of freeze/thaw damage, corroborated viability assessments and demonstrated that cryoinjury occurred even in surviving turtles. Irrespective of taxon, cryoinjury tended to be higher in smaller individuals and in those having relatively low water contents; however, bases for these associations were not apparent. Screening for certain organic osmolytes that might promote freezing survival by colligatively reducing ice content and limiting cell dehydration showed that the plasma of unfrozen (control) turtles contained small quantities of glucose (1.3-5.8 mmol l(-1)) and lactate (0.6-3.2 mmol l(-1)) and modest amounts of urea (range of mean values for all taxa 8.2-52.3 mmol l(-1)). Frozen/thawed turtles of all taxa accumulated modest amounts of glucose and lactate that jointly raised the plasma solute concentration by 30-100 mmol l(-1). We conclude that organic osmolytes accumulated both before and during freezing may promote survival in species that have evolved a tolerance to freezing, but are not necessarily accumulated for that purpose.

Descriptors: turtles adaptation, physiological, freezing, physiology, cryoprotective agents, osmolar concentration, Noth American species.

Cowles, R.B. and C.M. Bogert (2006). **Preliminary study of the thermal requirements of desert reptiles.** *Iguana* 13(1): 53-60. ISSN: 1554-916X.
Descriptors: reptiles, desert reptiles, thermal requirements , preliminary study.

Crews, D., S. Partesotti, R. Porter, M. Ramsey, J.K. Skipper, and M. Wu (2003). **Physiology of temperature-dependent sex determination in reptiles.** *SICB Annual Meeting and Exhibition Final Program and Abstracts* 2003: 145-146. ISSN: print: 1540-7063; online: 1557-7023.
Descriptors: reptiles, sex determination, temperature, physiology, meeting abstracts.
Notes: Meeting Information: Annual Meeting and Exhibition of the SICB (Society for Integrative and Comparative Biology), Toronto, ON, Canada; January 04-08, 2003.

DeNardo, D.F. (2004). **Understanding and meeting the thermal needs of the reptile patient**. *Small Animal and Exotics Book Two: Pain Management Zoonosis Proceedings of the North American Veterinary Conference, Volume 18* 18: 1323-1325. ISSN: 0341-6593.
Descriptors: reptile patient, thermal needs, conference proceedings, book chapter.

Diaz, J.A. and S. Cabezas Diaz (2004). **Seasonal variation in the contribution of different behavioural mechanisms to lizard thermoregulation.** *Functional Ecology* 18(6): 867-875. ISSN: 0269-8463.
NAL Call Number: QH540.F85
Descriptors: reptiles, lizard, thermoregulation, behavioral mechanisms, seasonal variation, temperature.

Diaz, J.A., P. Iraeta, and C. Monasterio (2006). **Seasonality provokes a shift of thermal preferences in a temperate lizard, but altitude does not.** *Journal of Thermal Biology* 31(3): 237-242. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: reptiles, temperate lizard, thermal preferences, seasonality, altitude, provokes, shift, thermal range.

Dinkelacker, S.A., J.P. Costanzo, and R.E.J. Lee (2005). **Anoxia tolerance and freeze tolerance in hatchling turtles.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 175(3): 209-217. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: Freezing survival in hatchling turtles may be limited by ischemic anoxia in frozen tissues and the associated accumulation of lactate and reactive oxygen species (ROS). To determine whether mechanisms for coping with anoxia are also important in freeze tolerance, we examined the association between capacities for freezing survival and anoxia tolerance in hatchlings of seven species of turtles. Tolerance to freezing (-2.5 degrees C) was high in *Emydoidea blandingii*, *Chrysemys picta*, *Terrapene ornata*, and *Malaclemys terrapin* and low in *Graptemys geographica*, *Chelydra serpentina*, and *Trachemys scripta*. Hatchlings survived in a N(2) atmosphere at 4 degrees C for periods ranging from 17 d (M. terrapin) to 50 d (G.

geographica), but survival time was not associated with freeze tolerance. Lactate accumulated during both stresses, but plasma levels in frozen/thawed turtles were well below those found in anoxia-exposed animals. Activity of the antioxidant enzyme catalase in liver increased markedly with anoxia exposure in most species, but increased with freezing/thawing only in species with low freeze tolerance. Our results suggest that whereas oxygen deprivation occurs during somatic freezing, freeze tolerance is not limited by anoxia tolerance in hatchling turtles.

Descriptors: turtles, acclimatization, physiology, anoxia, catalase metabolism, freezing, lactates, blood, liver anatomy, histology, enzymology, organ size, oxidative stress.

do Amaral, J.P., G.A. Marvin, and V.H. Hutchison (2002). **The influence of bacterial lipopolysaccharide on the thermoregulation of the box turtle *Terrapene carolina*.** *Physiological and Biochemical Zoology* 75(3): 273-282. ISSN: 1522-2152.

NAL Call Number: QL1.P52

Abstract: Ectotherms can adjust their thermoregulatory set points in response to bacterial infection; the result may be similar to endothermic fever. We examined the influence of dose on the set point of body temperature (T(b)) in *Terrapene carolina*. After acclimating postprandial turtles to 20 degrees C, we injected them with two doses of bacterial endotoxin (LPS; lipopolysaccharide from *Escherichia coli*), 0.0025 or 0.025 mg LPS/g nonshell body mass, or with reptilian saline (control group). We placed the animals singly in linear thigmothermal gradients and recorded their T(b)'s for 48 h. The turtles showed dose-influenced thermal selection. Turtles injected with the high dose had T(b)'s significantly higher than control turtles, whereas low-dose turtles had T(b)'s significantly lower than control turtles. Also, there was a low daily effect on the T(b) of the turtles injected with the high dose. High-dose turtles had significantly higher T(b)'s than the control turtles during the first day but not during the second. Our results support the prediction of Romanovsky and Szekely that an infectious agent may elicit opposite thermoregulatory responses depending on quality and quantity of the agent and the host health status.

Descriptors: reptiles, captive box turtle, *Terrapene carolina*, thermoregulation, bacterial lipopolysaccharide, influence, body temperature, postprandial.

Do Amaral, J.P.S., G.A. Marvin, and V.H. Hutchison (2002). **Thermoregulation in the box turtles *Terrapene carolina* and *Terrapene ornata*.** *Canadian Journal of Zoology* 80(5): 934-943. ISSN: 0008-4301.

NAL Call Number: 470 C16D

Descriptors: reptiles, box turtles, *Terrapene carolina* and *Terrapene ornata*, thermoregulation, habitats, desert, forest, differences, body temperature.

Drake, D.L. and J.R. Spotila (2002). **Thermal tolerances and the timing of sea turtle hatchling emergence** . *Journal of Thermal Biology* 27(1): 71-81. ISSN: 0306-4565.

NAL Call Number: QP82.2.T4J6

Descriptors: reptiles, sea turtle, hatchling emergence, thermal tolerances, sand temperatures.

Du, W.G. and X. Ji (2006). **Effects of constant and fluctuating temperatures on egg survival and hatchling traits in the northern grass lizard (*Takydromus septentrionalis*, Lacertidae).** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 305(1): 47-54. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Abstract: To understand how nest temperatures influence phenotypic traits of reptilian hatchlings, the effects of fluctuating temperature on hatchling traits must be known. Most investigations, however, have only considered the effects of constant temperatures. We incubated eggs of *Takydromus septentrionalis* (Lacertidae) at constant (24 degrees C, 27 degrees C, 30 degrees C and 33 degrees C) and fluctuating temperatures to determine the effects of these thermal regimes on incubation duration, hatching success and hatchling traits (morphology and locomotor performance). Hatching success at 24 degrees C and 27 degrees C was higher, and hatchlings derived from these two temperatures were larger and performed better than their counterparts from 30 degrees C and 33 degrees C. Eggs incubated at fluctuating temperatures exhibited surprisingly high hatching success and also produced large and well-performed hatchlings in spite of the extremely wide range of temperatures (11.6-36.2 degrees C) they experienced. This means that exposure of eggs to adversely low or high temperatures for short periods does not increase embryonic mortality. The variance of fluctuating temperatures affected hatchling morphology and locomotor performance more evidently than did the mean of the temperatures in this case. The head size and sprint speed of the hatchlings increased with increasing variances of fluctuating temperatures. These results suggest that thermal variances significantly affect embryonic development and phenotypic traits of hatchling reptiles and are therefore ecologically meaningful.
Descriptors: grass lizard, *Takydromus septentrionalis*, body constitution, energy metabolism, lizards growth and development, locomotion, temperature, physiological adaptation, newborn animals, embryonic development.

Du, W.G. and X. Ji (2002). **Effects of incubation temperature on duration of incubation. Hatching success, and hatching traits in the gray rat snake, *Ptyas korros* (Colubridae).** *Acta Ecologica Sinica* 22(4): 548-553. ISSN: 1000-0933.
Descriptors: reptiles, gray rat snake, *Ptyas korros*, incubation temperature, duration of incubation, hatching success.
Language of Text: Chinese; Summary in Chinese and English.

Ellis, D.J., B.T. Firth, and I. Belan (2006). **Circadian rhythm of behavioral thermoregulation in the sleepy lizard (*Tiliqua rugosa*)**. *Herpetologica* 62(3): 259-265. ISSN: 0018-0831.
NAL Call Number: QL640.H4
Descriptors: reptiles, sleepy lizard, *Tiliqua rugosa*, circadian rhythm, behavioral thermoregulation, body temperature, photoperiod, seasonal variation.

Franklin, C.E. and F. Seebacher (2003). **The effect of heat transfer mode on heart rate responses and hysteresis during heating and cooling in the estuarine crocodile *Crocodylus porosus*.** *Journal of Experimental Biology.* 206(Pt 7): 1143-1151. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.00222

NAL Call Number: 442.8 B77

Abstract: The effect of heating and cooling on heart rate in the estuarine crocodile *Crocodylus porosus* was studied in response to different heat transfer mechanisms and heat loads. Three heating treatments were investigated. *C. porosus* were: (1) exposed to a radiant heat source under dry conditions; (2) heated via radiant energy while half-submerged in flowing water at 23 degrees C and (3) heated via convective transfer by increasing water temperature from 23 degrees C to 35 degrees C. Cooling was achieved in all treatments by removing the heat source and with *C. porosus* half-submerged in flowing water at 23 degrees C. In all treatments, the heart rate of C. porosus increased markedly in response to heating and decreased rapidly with the removal of the heat source. Heart rate during heating was significantly faster than during cooling at any given body temperature, i.e. there was a significant heart rate hysteresis. There were two identifiable responses to heating and cooling. During the initial stages of applying or removing the heat source, there was a dramatic increase or decrease in heart rate ('rapid response'), respectively, indicating a possible cardiac reflex. This rapid change in heart rate with only a small change or no change in body temperature (<0.5 degrees C) resulted in Q(10) values greater than 4000, calling into question the usefulness of this measure on heart rate during the initial stages of heating and cooling. In the later phases of heating and cooling, heart rate changed with body temperature, with Q(10) values of 2-3. The magnitude of the heart rate response differed between treatments, with radiant heating during submergence eliciting the smallest response. The heart rate of *C. porosus* outside of the 'rapid response' periods was found to be a function of the heat load experienced at the animal surface, as well as on the mode of heat transfer. Heart rate increased or decreased rapidly when *C. porosus* experienced large positive (above 25 W) or negative (below -15 W) heat loads, respectively, in all treatments. For heat loads between -15 W and 20 W, the increase in heart rate was smaller for the 'unnatural' heating by convection in water compared with either treatment using radiant heating. Our data indicate that changes in heart rate constitute a thermoregulatory mechanism that is modulated in response to the thermal environment occupied by the animal, but that heart rate during heating and cooling is, in part, controlled independently of body temperature.

Descriptors: reptiles, estuarine crocodile, *Crocodylus porosus*, heat transfer mode, heart rate response, effect, hysteresis, heating, cooling, body temperature.

Galli, G., E.W. Taylor, and T. Wang (2004). **The cardiovascular responses of the freshwater turtle *Trachemys scripta* to warming and cooling.** *Journal of Experimental Biology.* 207(Pt 9): 1471-1478. ISSN: 0022-0949.

Online: http://dx.doi.org/10.1242/jeb.00912

NAL Call Number: 442.8 B77

Abstract: Seven freshwater turtles *Trachemys scripta* were instrumented with flow probes and cannulated for blood pressure measurements. The turtles were warmed from 24 to 34 degrees C, and cooled down to 24 degrees C, with and without atropine. Animals exhibited a hysteresis of heart rate and blood flow to both the pulmonary and systemic circulations, which was not cholinergically mediated. Blood pressure remained constant during both warming and cooling, while systemic resistance decreased during heating and increased during cooling, indicating a barostatic response. There was a large right-to-left (R-L) shunt during warming

and cooling in untreated animals, which remained relatively constant. Atropinisation resulted in a large L-R shunt, which decreased during warming and increased during cooling. Nevertheless, heating rates were the same in untreated and atropinised animals, and cooling rates were significantly longer in atropinised animals, indicating that shunt patterns contribute little to heat exchange.
Descriptors: reptiles, freshwater turtle, *Trachemys scripta*, cardiovascular responses, warming, cooling, atropine, blood pressure, body temperature, shunt.

Georges, A., K. Beggs, J.E. Young, and J.S. Doody (2005). **Modelling development of reptile embryos under fluctuating temperature regimes.** *Physiological and Biochemical Zoology* 78(1): 18-30. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: An increase in temperature, within bounds, will accelerate development of reptile embryos, and morphogenesis can be normal over a range of temperatures despite those varying rates of development. Less well understood is the form of the relationship that best describes variation in developmental rate with temperature. In this article, we apply a linear degree.hour model, an empirical curvilinear model, a biophysical model, and a polynomial model to data on rates of embryonic development and temperature in the pig-nosed turtle *Carettochelys insculpta* from northern Australia. The curvilinear models, which have been applied with success to development of insects, describe the embryonic development of turtles well. When fluctuating temperatures extend beyond the constant temperatures that support successful incubation, the curvilinear models continue to perform well, whereas the linear model predictions fail. Sensitivity analysis indicates that under some circumstances, incubation duration may be increased by diel temperature fluctuations, independent of an influence of mean temperature. In other circumstances, incubation duration may be decreased, and in still other circumstances, diel temperature fluctuations will have no impact on incubation duration. This adds an additional dimension to our understanding of how thermal regimes can be selected or manipulated by reptiles to optimise incubation duration and the timing of offspring emergence.
Descriptors: pig nosed turtle, *Carettochelys insculpta*, embryo , physiology, models, temperature, development, morphogenesis, thermal regimes.

Glen, F., A.C.G.B.J. Broderick, and G.C. Hays (2003). **Incubation environment affects phenotype of naturally incubated green turtle hatchlings.** *Journal of the Marine Biological Association of the United Kingdom* 83(5): 1183-1186 . ISSN: print: 0025-3154; online: 1469-7769.
Descriptors: reptiles, green turtle hatchlings, incubation environment, phenotype, affects, body size.

Godfrey, M.H. and N. Mrosovsky (2006). **Pivotal temperature for green sea turtles, *Chelonia mydas*, nesting in Suriname.** *Herpetological Journal* 16(1): 55-61. ISSN: 0268-0130.
Descriptors: reptiles, green sea turtles, *Chelonia mydas*, pivotal temperature, sexual differentiation, nesting, Surinam.

Herczeg, G., T. Kovacs, T. Toth, J. Torok, Z. Korsos , and J. Merila (2004). **Tail loss and thermoregulation in the common lizard *Zootoca vivipara*.** *Die Naturwissenschaften* 91(10): 485-488. ISSN: print: 0028-1042; online: 1432-1904.

Abstract: Tail autotomy in lizards is an adaptive strategy that has evolved to reduce the risk of predation. Since tail loss reduces body mass and moving ability-which in turn are expected to influence thermal balance-there is potential for a trade-off between tail autotomy and thermoregulation. To test this hypothesis, we studied a common lizard (*Zootoca vivipara*) population at high latitude, inhabiting a high-cost thermal environment. *Z. vivipara* is a small, non-territorial lizard known as a very accurate thermoregulator. We made two predictions: (1) the reduced body weight due to tail loss results in faster heating rate (a benefit), and (2) the reduction in locomotor ability after tail loss induces a shift to the use of thermally poorer microhabitats (a cost), thus decreasing the field body temperatures of active lizards. We did not find any effect of tail loss on heating rate in laboratory experiments conducted under different thermal conditions. Likewise, no significant relationship between tail condition and field body temperatures, or between tail condition and thermal microhabitat use, were detected. Thus, our results suggest that tail autotomy does not influence the accuracy of thermoregulation in small-bodied lizards.

Descriptors: common lizard, *Zootoca vivipara*, body temperature regulation, lizards physiology, tail, body size, body temperature, ecosystem, lizards anatomy and histology.

Herczeg, G., A. Gonda, J. Saarikivi, and J. Merila (2006). **Experimental support for the cost-benefit model of lizard thermoregulation.** *Behavioral Ecology and Sociobiology* 60(3): 405-414. ISSN: 0340-5443.

Descriptors: reptiles, thermoregulation, cost benefit, lizard model, experimental support, behavioral thermoregulation, body temperature.

Hochscheid, S., F. Bentivegna, and J.R. Speakman (2004). **Long-term cold acclimation leads to high Q10 effects on oxygen consumption of loggerhead sea turtles *Caretta caretta*.** *Physiological and Biochemical Zoology* 77(2): 209-222. ISSN: 1522-2152.

NAL Call Number: QL1.P52

Abstract: We monitored oxygen consumption (VO2), body temperatures (Tb), submersion intervals, and circadian rhythms of VO2 in nine loggerhead turtles during a 6-mo period. The turtles originated from the Tyrhennian Sea, South Italy (40 degrees 51'N, 14 degrees 17'E) and were kept in indoor tanks at constant photoperiod while being subject to the seasonal decline in water temperature (Tw=27.1 degrees to 15.3 degrees C). From summer to winter, all turtles underwent profound reductions in VO2 (Q10=5.4). Simultaneously, their activity was greatly reduced and submergence intervals increased. Over 24-h periods, however, the turtles showed no circadian rhythm in activity or VO2. However, there was a significant positive correlation between the proportion of a day spent actively swimming and VO2. Tb's were not significantly different from Tw and followed the same seasonal decline. A second experiment was conducted to establish the effect of short-term exposure to various temperatures on VO2. Tb equilibrated with the experimental Tw within 3 h. The metabolic responses were again positively correlated with changes in Tw, but this time the corresponding Q10 was only 1.3. On the basis of the range of body masses of the turtles used in this

study (2-60 kg), the intraspecific scaling exponent for VO2 was 0.353.
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta* , long term cold, oxygen consumption, effects, body temperature, acclimation, submersion intervals.

Hochscheid, S., F. Bentivegna, and J.R. Speakman (2002). **Regional blood flow in sea turtles: implications for heat exchange in an aquatic ectotherm.** *Physiological and Biochemical Zoology* 75(1): 66-76. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Despite substantial knowledge on thermoregulation in reptiles, the mechanisms involved in heat exchange of sea turtles have not been investigated in detail. We studied blood flow in the front flippers of two green turtles, *Chelonia mydas*, and four loggerhead turtles, *Caretta caretta*, using Doppler ultrasound to assess the importance of regional blood flow in temperature regulation. Mean blood flow velocity and heart rate were determined for the water temperature at which the turtles were acclimated (19.3 degrees-22.5 degrees C) and for several experimental water temperatures (17 degrees-32 degrees C) to which the turtles were exposed for a short time. Flipper circulation increased with increasing water temperature, whereas during cooling, flipper circulation was greatly reduced. Heart rate was also positively correlated with water temperature; however, there were large variations between individual heart rate responses. Body temperatures, which were additionally determined for the two green turtles and six loggerhead turtles, increased faster during heating than during cooling. Heating rates were positively correlated with the difference between acclimation and experimental temperature and negatively correlated with body mass. Our data suggest that by varying circulation of the front flippers, turtles are capable of either transporting heat quickly into the body or retaining heat inside the body, depending on the prevailing thermal demands.
Descriptors: reptiles, sea turtles, *Caretta caretta*, regional blood flow, heat exchange, implications, flipper blood flow, body temperatures.

Ibarguengoytia, N.R. (2005). **Field, selected body temperature and thermal tolerance of the syntopic lizards *Phymaturus patagonicus* and *Liolaemus elongatus* (Iguania: Liolaemidae).** *Journal of Arid Environments* 62(3): 435-448. ISSN: 0140-1963.
NAL Call Number: QH541.5.D4J6
Descriptors: reptiles, lizards, *Phymaturus patagonicus*, *Liolaemus elongatus*, Iguanidae, air temperature, body temperature, heat tolerance, thermoregulation, animal reproduction , animal morphology, Argentina.

Klein, W., D.V. Andrade, T. Wang, and E.W. Taylor (2002). **Effects of temperature and hypercapnia on ventilation and breathing pattern in the lizard *Uromastyx aegyptius microlepis*.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 132(4): 847-859. ISSN: 1095-6433.
Abstract: In most reptiles, the ventilatory response to hypercapnia consists of large increases in tidal volume (V(T)), whereas the effects on breathing frequency (f(R)) are more variable. The increased V(T) seems to arise from direct inhibition of pulmonary stretch receptors. Most reptiles also exhibit a transitory increase in ventilation upon removal of CO(2) and

this post-hypercapnic hyperpnea may consist of changes in both V(T) and f(R). While it is well established that increased body temperature augments the ventilatory response to hypercapnia, the effects of temperature on the post-hypercapnic hyperpnea is less described. In the present study, we characterise the ventilatory response of the agamid lizard *Uromastyx aegyptius* to hypercapnia and upon the return to air at 25 and 35 degrees C. At both temperatures, hypercapnia caused large increases in V(T) and small reductions in f(R), that were most pronounced at the higher temperature. The post-hypercapnic hyperpnea, which mainly consisted of increased f(R), was numerically larger at 35 compared to 25 degrees C. However, when expressed as a proportion of the levels of ventilation reached during steady-state hypercapnia, the post-hypercapnic hyperpnea was largest at 25 degrees C. Some individuals exhibited buccal pumping where each expiratory thoracic breath was followed by numerous small forced inhalations caused by contractions of the buccal cavity. This breathing pattern was most pronounced during severe hypercapnia and particularly evident during the post-hypercapnic hyperpnea.
Descriptors: reptiles, lizard, *Uromastyx aegyptius microlepis*, temperature , hypercapnia, effects, ventilation, breathing, tidal volume, breathing frequency.

Krosniunas, E.H. and J.W. Hicks (2003). **Cardiac output and shunt during voluntary activity at different temperatures in the turtle, *Trachemys scripta*.** *Physiological and Biochemical Zoology* 76(5): 679-694. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Red-eared slider turtles (*Trachemys scripta*) were chronically instrumented with blood flow probes for a long-term study of voluntary behavior in an enriched laboratory setting. Cardiovascular measures consisting of total cardiac output (Q(tot)), pulmonary blood flow (Q(pul)), systemic blood flow (Q(sys)), net cardiac shunt (Q(shunt)), heart rate (HR), and stroke volume (SV) were obtained during spontaneous activity at a constant body temperature (Tb=2 degrees C) and at unstable (variable) T(b)'s ranging from 19 degrees to 37 degrees C. The effects of temperature and activity differed between the pulmonary and systemic circuits, with increases in Q(sys) due to HR alone, while both HR and SV contributed to gains in Q(pul). At stable 20 degrees C, cardiovascular responses during diving, submerged swimming, and walking were qualitatively similar, and increases in Q(tot) during activity (approximately 2 x resting levels) were due to greater gains in Q(pul) than Q(sys). At unstable T(b)'s and in general, net Q(shunt) while active depended on the integration of individual physiological influences such as heating, cooling, and initial behavioral state acting on the cardiovascular system. During activity, net left-to-right (L-R) shunts predominated at constant T(b) of 20 degrees C (mean shunt fraction approximately 30%-40%), while both net L-R and right-to-left (R-L) shunts of varying size were found at unstable T(b)'s (19 degrees - 37 degrees C).
Descriptors: reptiles, turtle, *Trachemys scripta*, cardiac output, shunt, voluntary activity, different temperatures, body temperature, heart rate.

Ladyman, M. and D. Bradshaw (2003). **The influence of dehydration on the thermal preferences of the Western tiger snake, *Notechis scutatus*.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 173(3): 239-246. ISSN: print: 0174-1578;

online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: Temperature selection in tiger snakes (*Notechis scutatus*) is strongly influenced by hydration state and this response varies between two distinct neighbouring populations on semi-arid Carnac Island and mainland wetland (Herdsman Lake). Fed and hydrated (control) Carnac Island snakes selected a preferred body temperature of 26.2+/-1.2 degrees C and an average maximum temperature of 32.5+/-0.5 degrees C in a photo-thermal gradient. Dehydrated Carnac Island snakes selected a significantly lower preferred body temperature (19.7+/-1.6 degrees C) and average maximum temperature (27.7+/-1.0 degrees C). Control Herdsman Lake snakes selected a preferred body temperature of 27.5+/-0.6 degrees C and an average maximum temperature of 33.3+/-0.4 degrees C. Dehydrated Herdsman Lake snakes selected a significantly lower preferred body temperature (23.3+/-1.1 degrees C) and a lower average maximum temperature (31.8+/-0.6 degrees C). Thermal depression (decreased preferred body and average maximum temperatures) in response to dehydration was greater for Carnac Island than Herdsman Lake snakes. As decreases in temperature and activity can reduce water loss, our laboratory data suggest that the survival of the relict population of tiger snakes on Carnac Island is associated with thermoregulatory modifications, which may have the effect of enhancing water conservation in this waterless habitat.
Descriptors: reptiles, western tiger snake, *Notechis scutatus*, dehydration, influence, thermal preferences, hydration state, body temperature.

Lance, V.A. (2003). **Alligator physiology and life history: the importance of temperature**. *Experimental Gerontology* 38(7): 801-805. ISSN: 0531-5565.
Descriptors: reptiles, alligators, physiology, life history, temperature, annual thermal cycles, ambient temperature, anorexia below 16 degrees C, conference proceedings.
Notes: Meeting Information: Proceedings of the 2nd Symposium on Organisms with Slow Aging (SOSA-2), Los Angeles, USA, 17-18 January 2003.

Langkilde, T. and R. Shine (2005). **Different optimal offspring sizes for sons versus daughters may favor the evolution of temperature-dependent sex determination in viviparous lizards.** *Evolution International Journal of Organic Evolution* 59(10): 2275-2280. ISSN: print: 0014-3820; online: 1558-5646.
NAL Call Number: 443.8 Ev62
Abstract: Temperature-dependent sex determination (TSD) has evolved independently in at least two lineages of viviparous Australian scincid lizards, but its adaptive significance remains unclear. We studied a montane lizard species (*Eulamprus heatwolei*) with TSD. Our data suggest that mothers can modify the body sizes of their offspring by selecting specific thermal regimes during pregnancy (mothers with higher and more stable temperatures produced smaller offspring), but cannot influence sons versus daughters differentially in this way. A field mark-recapture study shows that optimal offspring size differs between the sexes: larger body size at birth enhanced the survival of sons but reduced the survival of daughters. Thus, a pregnant female can optimize the fitness of either her sons or her daughters (via yolk allocation and thermoregulation), but cannot simultaneously optimize both. One evolutionary solution to reduce this fitness cost is to modify the sex-determining mechanism so that

a single litter consists entirely of either sons or daughters; TSD provides such a mechanism. Previous work has implicated a sex difference in optimal offspring size as a selective force for TSD in turtles. Hence, opposing fitness determinants of sons and daughters may have favored evolutionary transitions from genetic sex determination to TSD in both oviparous turtles and viviparous lizards.
Descriptors: viviparous lizards, sex determination, temperature dependent sex determination, TSD, offspring sizes, evolution.

Litvinov, N. and S. Ganshchuk (2005). **Environment and body temperatures of reptiles in Volga-Ural region.** *Russian Journal of Herpetology* 12(Suppl.): 179-182. ISSN: 1026-2296.
Descriptors: reptiles, body temperature, environmental temperature, cardiovascular response, circulatory system, Eurasia, Volga Ural region.

Litzgus, J.D. and W.A. Hopkins (2003). **Effect of temperature on metabolic rate of the mud turtle (*Kinosternon subrubrum*).** *Journal of Thermal Biology* 28(8): 595-600. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: reptiles, mud turtle, *Kinosternon subrubrum*, temperature, metabolic rate, effect, oxygen consumption, ectotherms.

Liu, C., R. Li, Z. Liu, S. Yin, and Z. Wang (2006). **The role of prostaglandins and the hypothalamus in thermoregulation in the lizard, *Phrynocephalus przewalskii* (Agamidae).** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 176(4): 321-328. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: Typically, small lizards rely heavily on behavioral thermoregulation rather than physiological mechanisms to control their rates of warming and cooling. We tested the hypothesis that prostaglandins participate in mediating the cardiovascular response to heating and cooling and temperature regulating neurons in the hypothalamus of the small lizard *Phrynocephalus przewalskii*. In vivo and in vitro treatments, heart rates (HRs) were all found to be higher during heating than during cooling, hysteresis was distinct below 30 and 26 degrees Celsius, respectively. In vivo, as administration of COX inhibitor, there were no differences in HR between heating and cooling at any body temperature and administration of agonist prostaglandins only produced a significant effect on HR below 25 degrees Celsius. Single-unit activity was recorded extracellularly in vitro with microelectrodes, found the firing rate of the continuous unit increased 23% when the temperature of the artificial cerebrospinal fluid dropped from 30-20 degrees Celsius. We conclude that prostaglandins appear to play only a limited role in modulating heart activity in *Phrynocephalus przewalskii* and suggest that cold-sensitive neurons in the preoptic and anterior hypothalamus (PO/AH) are involved in thermoregulatory control during heating or cooling.
Descriptors: lizards, *Phrynocephalus przewalskii*, body temperature regulation, heart rate, drug effects, hypothalamus, blood supply, prostaglandins, pharmacology, regional blood flow , sodium chloride pharmacology.

Llewelyn, J., R. Shine, and J.K. Webb (2006). **Time of testing affects locomotor performance in nocturnal versus diurnal snakes.** *Journal of Thermal Biology* 31(3): 268-273. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: reptiles, nocturnal snakes, diurnal snakes, locomotor performance, time of testing, affects, time of day.

Lu, H.L., X. Ji, L.H. Lin, and L. Zhang (2006). **Relatively low upper threshold temperature in lizards from cool habitats.** *Journal of Thermal Biology* 31(3): 256-261. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: reptiles, lizards, cool habitats, low upper threshold temperature, incubation temperature, forest skink.

Lutterschmidt, D.I., W.I. Lutterschmidt, N.B. Ford, and V.H. Hutchison (2002). **Behavioral thermoregulation and the role of melatonin in a nocturnal snake.** *Hormones and Behavior* 41(1): 41-50. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Abstract: Daily and seasonal variations in hormone levels influence the complex interactions between behavior and physiology. Ectothermic animals possess the unique ability behaviorally to adjust body temperature (T(b)) to control physiological rate processes. Thus, a hormone may indirectly influence a physiological rate by directly influencing the behaviors that adjust or control that rate process. Although many hormonal influences on behavioral regulation of T(b) remain uninvestigated, melatonin (MEL) generally is considered a hormone that decreases mean preferred T(b). Many ectotherms demonstrate the selection of lower T(b)'s in response to increased MEL concentrations. Here, we examined the influence of MEL on the behavioral regulation of T(b) in the nocturnal African house snake *Lamprophis fuliginosus*. A series of experiments with two injection regimes of MEL had no significant effect on the mean preferred T(b) of *L. fuliginosus*. In addition, mean preferred T(b)'s during the photophase did not differ significantly from those during scotophase. Our findings suggest that *L. fuliginosus* does not respond to elevated concentrations of either endogenous or exogenous MEL. To verify that the African house snake is nocturnal, we investigated activity patterns of *L. fuliginosus* throughout the photoperiod. The activity period of *L. fuliginosus* occurs in the scotophase of the photoperiod, a pattern consistent with that of nocturnal species. This suggests that nocturnal organisms such as *L. fuliginosus* may not respond to MEL in the same manner as many diurnal species. Our results support the hypothesis that some animals, particularly nocturnal species, may have developed alternative responses to increased plasma concentrations of MEL.
Descriptors: reptiles, nocturnal snake, *Lamprophis fuliginosus*, behavioral thermoregulation, role of melatonin, body temperature.

McConnachie, S. and G.J. Alexander (2004). **The effect of temperature on digestive and assimilation efficiency, gut passage time and appetite in an ambush foraging lizard, *Cordylus melanotus melanotus*.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 174(2): 99-105. ISSN: print: 0174-1578; online: 1432-136X.

NAL Call Number: QP33.J681
Abstract: In ectotherms, an increase in body temperature increases metabolic rate and may increase rates of digestive processes. We measured the thermal dependence of the apparent digestive and apparent assimilation efficiencies (ADE and AAE), gut passage time (GP) and appetite in *Cordylus melanotus melanotus*, a medium sized Crag Lizard, which is endemic to South Africa. Trials were conducted at 20, 22, 25, 30, 32 and 35 degrees C under controlled conditions. Trials lasted 14 days, during which, lizards were fed ca. 1 g mealworms per day. Glass beads were used as markers to determine GP at the beginning and end of trials. Faeces and urates were collected daily and oven dried at 50 degrees C. The energy content of egested matter was then measured using bomb calorimetry. ADE and AAE were not affected by temperature for either males or females. The mean+/-SE ADE and AAE were 94.4+/-0.3% and 87.2+/-0.6%, respectively. GP was not significantly different between males and females at any temperature, but decreased significantly with increasing temperature. Appetite was significantly different between the different temperatures measured. The decrease of gut passage time with increasing temperature was expected, since the digestive and assimilation efficiencies are similar over the range of temperatures tested. Lizards are thus assimilating a similar proportion of ingested energy, but at faster rates at higher temperatures. The results indicate that the digestive physiology of this species results in maximum energy gain per meal in environments where food is scarce.
Descriptors: reptiles, Crag lizard, *Cordylus melanotus melanotus*, digestive efficiency, assimilation efficiency, gut passage time, appetite, effect of temperature.

Mcconnachie, S., G.J. Alexander, and M.J. Whiting (2007). **Lower temperature tolerance in the temperate, ambush foraging lizard *Pseudocordylus melanotus melanotus*.** *Journal of Thermal Biology* 32(2): 66-71. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: reptiles, lizard, *Pseudocordylus melanotus melanotus*, temperature tolerance, lower, critical minimum, thermal limit, lower lethal temperature, thermal tolerance.

Meek, R. (2005). **Null models and the thermal biology of the anguid lizard *Anguis fragilis*; evidence for thermoregulation?** *Amphibia Reptilia* 26(4): 445-450. ISSN: 0173-5373.
Descriptors: reptiles, anguid lizard, *Anguis fragilis*, thermal biology, thermoregulation, null models, body temperature.

O'Donnell, R.P. and S.J. Arnold (2005). **Evidence for selection on thermoregulation: effects of temperature on embryo mortality in the garter snake *Thamnophis elegans*.** *Copeia* 2005(4): 930-934. ISSN: 0045-8511.
Descriptors: reptiles, garter snake, *Thamnophis elegans*, thermoregulation, effects of temperature, embryo mortality.

Overgaard, J., T. Wang, O.B. Nielsen, and H. Gesser (2005). **Extracellular determinants of cardiac contractility in the cold anoxic turtle.** *Physiological and Biochemical Zoology* 78(6): 976-995. ISSN: 1522-2152.
NAL Call Number: QL1.P52

Abstract: Painted turtles (*Chrysemys picta*) survive months of anoxic submergence, which is associated with large changes in the extracellular milieu where pH falls by 1, while extracellular K+, Ca++, and adrenaline levels all increase massively. While the effect of each of these changes in the extracellular environment on the heart has been previously characterized in isolation, little is known about their interactions and combined effects. Here we examine the isolated and combined effects of hyperkalemia, acidosis, hypercalcemia, high adrenergic stimulation, and anoxia on twitch force during isometric contractions in isolated ventricular strip preparations from turtles. Experiments were performed on turtles that had been previously acclimated to warm (25 degrees C), cold (5 degrees C), or cold anoxia (submerged in anoxic water at 5 degrees C). The differences between acclimation groups suggest that cold acclimation, but not anoxic acclimation per se, results in a downregulation of processes in the excitation-contraction coupling. Hyperkalemia (10 mmol L(-1) K+) exerted a strong negative inotropic effect and caused irregular contractions; the effect was most pronounced at low temperature (57%-97% reductions in twitch force). Anoxia reduced twitch force at both temperatures (14%-38%), while acidosis reduced force only at 5 degrees C (15%-50%). Adrenergic stimulation (10 micromol L(-1)) increased twitch force by 5%-19%, but increasing extracellular [Ca++] from 2 to 6 mmol L(-1) had only small effects. When all treatments were combined with anoxia, twitch force was higher at 5 degrees C than at 25 degrees C, whereas in normoxia twitch force was higher at 25 degrees C. We propose that hyperkalemia may account for a large part of the depressed cardiac contractility during long-term anoxic submergence.
Descriptors: painted turtles, *Chrysemys picta*, anoxic, cold, cardiac contractility, extracellular determinants, long term anoxic submergence.

Packard, G.C. and M.J. Packard (2006). **The relationship between gut contents and supercooling capacity in hatchling painted turtles (*Chrysemys picta*).** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 144(1): 98-104. ISSN: 1095-6433.

Abstract: Painted turtles (*Chrysemys picta*) typically spend their first winter of life in a shallow, subterranean hibernaculum (the natal nest) where they seemingly withstand exposure to ice and cold by resisting freezing and becoming supercooled. However, turtles ingest soil and fragments of eggshell as they are hatching from their eggs, and the ingestate usually contains efficient nucleating agents that cause water to freeze at high subzero temperatures. Consequently, neonatal painted turtles have only a modest ability to undergo supercooling in the period immediately after hatching. We studied the limit for supercooling (SCP) in hatchlings that were acclimating to different thermal regimes and then related SCPs of the turtles to the amount of particulate matter in their gastrointestinal (GI) tract. Turtles that were transferred directly from 26 degrees C (the incubation temperature) to 2 degrees C did not purge soil from their gut, and SCPs for these animals remained near -4 degrees C for the 60 days of the study. Animals that were held at 26 degrees C for the duration of the experiment usually cleared soil from their GI tract within 24 days, but SCPs for these turtles were only slightly lower after 60 days than they were at the outset of the experiment. Hatchlings that were acclimating slowly to 2 degrees C cleared soil from their gut within 24 days and realized a modest reduction in their SCP. However, the limit of supercooling in the slowly acclimating animals continued to decline even after all particulate material had been removed from

their GI tract, thereby indicating that factors intrinsic to the nucleating agents themselves also may have been involved in the acclimation of hatchlings to low temperature. The lowest SCPs for turtles that were acclimating slowly to 2 degrees C were similar to SCPs recorded in an earlier study of animals taken from natural nests in late autumn, so the current findings affirm the importance of seasonally declining temperatures in preparing animals in the field to withstand conditions that they will encounter during winter.
Descriptors: turtles, *Chrysemys picta*, acclimatization physiology, body temperature regulation, digestive system metabolism, hibernation physiology, turtles physiology, cold, species specificity.

Packard, G.C. and M.J. Packard (2003). **Natural freeze-tolerance in hatchling painted turtles?** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 134(2): 233-246. ISSN: 1095-6433.
Abstract: Hatchlings of the North American painted turtle (Family Emydidae: *Chrysemys picta*) typically spend their first winter of life inside a shallow, subterranean hibernaculum (the natal nest) where life-threatening conditions of ice and cold commonly occur. Although a popular opinion holds that neonates exploit a tolerance for freezing to survive the rigors of winter, hatchlings are more likely to withstand exposure to ice and cold by avoiding freezing altogether-and to do so without the benefit of an antifreeze. In the interval between hatching by turtles in late summer and the onset of wintery weather in November or December, the integument of the animals becomes highly resistant to the penetration of ice into body compartments from surrounding soil, and the turtles also purge their bodies of catalysts for the formation of ice. These two adjustments, taken together, enable the animals to supercool to temperatures below those that they routinely experience in nature. However, cardiac function in hatchlings is diminished at subzero temperatures, thereby compromising the delivery of oxygen to peripheral tissues and eliciting an increase in reliance by those tissues on anaerobic metabolism for the provision of ATP. The resulting increase in production of lactic acid may disrupt acid/base balance and lead to death even in animals that remain unfrozen. Although an ability to undergo supercooling may be key to survival by overwintering turtles in northerly populations, a similar capacity to resist inoculation and undergo supercooling characterizes animals from a population near the southern limit of distribution, where winters are relatively benign. Thus, the suite of characters enabling hatchlings to withstand exposure to ice and cold may have been acquired prior to the northward dispersal of the species at the end of the Pleistocene, and the characters may not have originated as adaptations specifically to the challenges of winter.
Descriptors: reptiles, hatchling painted turtles, *Chrysemys picta*, natural freeze tolerance, ice, cold, cardiac function, oxygen delivery, North America.

Packard, G.C. and M.J. Packard (2003). **Effect of cold-acclimation on capacity for supercooling in hatchling painted turtles.** *SICB Annual Meeting and Exhibition Final Program and Abstracts* 2003: 267-268. ISSN: print: 1540-7063; online: 1557-7023.
Descriptors: reptiles, painted turtles, *Chrysemys picta*, supercooling, cold acclimation, effect, capacity, meeting abstracts.

Notes: Meeting Information: Annual Meeting and Exhibition of the SICB (Society for Integrative and Comparative Biology), Toronto, ON, Canada; January 04-08, 2003.

Packard, G.C. and M.J. Packard (2004). **Natural freeze-tolerance in reptiles.** *CryoLetters* 25(3): 235-236. ISSN: 0143-2044.
Descriptors: reptiles, natural freeze tolerance, temperature, hibernation.

Packard, M.J. and G.C. Packard (2003). **Cold acclimation and cutaneous resistance to freezing in hatchling painted turtles, *Chrysemys picta.*** *SICB Annual Meeting and Exhibition Final Program and Abstracts* 2003: 268. ISSN: print: 1540-7063; online: 1557-7023.
Descriptors: reptiles, cold acclimation, freezing, hatchling painted turtles , *Chrysemys picta*, cutaneous resistance, meeting abstrascts.
Notes: Meeting Information: Annual Meeting and Exhibition of the SICB (Society for Integrative and Comparative Biology), Toronto, ON, Canada; January 4-8, 2003.

Pafilis, P., J. Foufopoulos, N. Poulakakis, P. Lymberakis, and E. Valakos (2007). **Digestive performance in five Mediterranean lizard species: effects of temperature and insularity.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 177(1): 49-60. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: Temperature sensitivity of digestive processes has important ramifications for digestive performance in ectothermic vertebrates. We conducted a comparative analysis of temperature effects on digestive processes [gut passage times (GPTs) and apparent digestive efficiencies (ADEs)] in five lacertid lizards occurring in insular (*Podarcis erhardii, P. gaigeae*), and mainland (*P. muralis, P. peloponnesiaca, Lacerta graeca*) Mediterranean environments. GPTs were negatively correlated to temperature with mainland taxa having 10-20% longer GPTs than island taxa. In contrast to previous studies that estimate ADEs using bomb calorimetry, we compare ADEs by analyzing discrete efficiencies for lipids, sugars and proteins at three temperature regimes (20, 25, and 30 degrees C); each of these categories produces different results. ADEs for lipids and sugars showed a monotonic increase with temperature whereas ADEs for proteins decreased with temperature. Island taxa had consistently higher ADEs than their mainland counterparts for lipids and for proteins but not for sugars. They are characterized by superior energy acquisition abilities despite significantly shorter GPTs. Their increased digestive performance relative to the mainland species appears to allow them to maximize energy acquisition in unproductive island environments where food availability is spatially and seasonally clustered.
Descriptors: reptiles, Mediterranean lacertid lizards, digestive performance, effects of temperature, insularity, gut passage time, apparent digestive efficiencies.

Petersen, A.M., T.T. Gleeson, and D.A. Scholnick (2003). **The effect of oxygen and adenosine on lizard thermoregulation.** *Physiological and Biochemical Zoology* 76(3): 339-347. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: A regulated decrease in internal body temperature (Tb) appears to play a protec-

tive role against metabolic disruptions such as exposure to ambient hypoxia. This study examined the possibility that Tb depression is initiated when low internal oxygen levels trigger the release of adenosine, a neural modulator known to influence thermoregulation. We measured selected Tb of *Anolis sagrei* in a thermal gradient under varied ambient oxygen conditions and following the administration of the adenosine receptor antagonist 8-cyclopentyltheophylline (CPT). The average decrease in Tb observed following exposure to hypoxia (<10% O2) and following exhaustive exercise were 5 degrees and 3 degrees C, respectively, suggesting a role of oxygen availability on initiation of regulated hypothermia. When *A. sagrei* were run to exhaustion and recovered in hyperoxic (>95% O2) conditions, exercise-induced Tb depression was abolished. Administration of CPT similarly abolished decreased Tb due to both exercise and hypoxia. Trials using *Dipsosaurus dorsalis* indicate that elevated ambient oxygen during exercise does not influence blood pH or lactate accumulation, suggesting that these factors do not initiate changes in thermoregulatory setpoint following exhaustive exercise. We suggest that when oxygen is limiting, a decrease in arterial oxygen may trigger the release of adenosine, thereby altering the thermoregulatory setpoint.
Descriptors: reptiles, lizard, thermoregulation, oxygen, adenosine, effect, body temperature, ambient hypoxia, blood pH.

Pieau, C. and M. Dorizzi (2004). **Oestrogens and temperature-dependent sex determination in reptiles: All is in the gonads.** *Journal of Endocrinology* 181(3): 367-377. ISSN: 0022-0795.
Online: http://dx.doi.org/10.1677/joe.0.1810367
NAL Call Number: 448.8 J8293
Abstract: In many species of oviparous reptiles, the first steps of gonadal sex differentiation depend on the incubation temperature of the eggs. Feminization of gonads by exogenous oestrogens at a male-producing temperature and masculinization of gonads by antioestrogens and aromatase inhibitors at a female-producing temperature have irrefutably demonstrated the involvement of oestrogens in ovarian differentiation. Nevertheless, several studies performed on the entire gonad/adrenal/mesonephros complex failed to find differences between male- and female-producing temperatures in oestrogen content, aromatase activity and aromatase gene expression during the thermosensitive period for sex determination. Thus, the key role of aromatase and oestrogens in the first steps of ovarian differentiation has been questioned, and extragonadal organs or tissues, such as adrenal, mesonephros, brain or yolk, were considered as possible targets of temperature and sources of the oestrogens acting on gonadal sex differentiation.In disagreement with this view, experiments and assays carried out on the gonads alone, i.e. separated from the adrenal/mesonephros, provide evidence that the gonads themselves respond to temperature shifts by modifying their sexual differentiation and are the site of aromatase activity and oestrogen synthesis during the thermosensitive period. Oestrogens act locally on both the cortical and the medullary part of the gonad to direct ovarian differentiation. We have concluded that there is no objective reason to search for the implication of other organs in the phenomenon of temperature-dependent sex determination in reptiles. From the comparison with data obtained in other vertebrates, we propose two main directions for future research: to examine how transcription of the aromatase gene is regulated and to identify molecular and cellular targets of oestrogens in gonads during sex differentiation, in species with strict genotypic sex determination and species with

temperature-dependent sex determination.
Descriptors: reptiles, sex determination, gonads, estrogens, temperture dependent, incubation temperature.

Plummer, M.V., T.L. Crabill, N.E. Mills, and S.L. Allen (2005). **Body temperatures of free-ranging softshell turtles (*Apalone spinifera*) in a small stream.** *Herpetological Review* 36(4): 371-375. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, softshell turtles, *Apalone spinifera*, body temperature, free ranging, small stream, thermoregulation.

Plummer, M.V., B.K. Williams, M.M. Skiver, and J.C. Carlyle (2003). **Effects of dehydration on the critical thermal maximum of the desert box turtle (*Terrapene ornata luteola*).** *Journal of Herpetology* 37(4): 747-750. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: reptiles, desert box turtle, *Terrapene ornata luteola*, dehydration, effects, critical thermal maximum.

Quinn, A.E., A. Georges, S.D. Sarre, F. Guarino, T. Ezaz, and J.A. Graves (2007). **Temperature sex reversal implies sex gene dosage in a reptile.** *Science* 316(5823): 411. ISSN: 0036-8075.
Abstract: Sex in reptiles is determined by genes on sex chromosomes or by incubation temperature. Previously these two modes were thought to be distinct, yet we show that high incubation temperatures reverse genotypic males (ZZ) to phenotypic females in a lizard with ZZ and ZW sex chromosomes. Thus, the W chromosome is not necessary for female differentiation. Sex determination is probably via a dosage-sensitive male-determining gene on the Z chromosome that is inactivated by extreme temperatures. Our data invite a novel hypothesis for the evolution of temperature-dependent sex determination (TSD) and suggest that sex chromosomes may exist in many TSD reptiles.
Descriptors: reptiles, temperature, sex reversal, sex gene, dosage, sex chromosomes, incubation, temperature dependent sex deterimation.

Radmilovich, M., A. Fernandez, and O. Trujillo Cenoz (2003). **Environment temperature affects cell proliferation in the spinal cord and brain of juvenile turtles.** *Journal of Experimental Biology.* 206(Pt 17): 3085-3093. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.00515
NAL Call Number: 442.8 B77
Abstract: The spinal cords and brains--comprising dorsal cortex (DC), medial cortex (MC) and diencephalon (Dien)--of juvenile turtles acclimated to warm temperature [27-30 degrees C; warm-acclimated turtles (WATs)] revealed higher density values of bromodeoxyuridine-labeled cells (BrdU-LCs) than those acclimated to a cooler environment [5-14 degrees C; cold-acclimated turtles (CATs)]. Both populations were under the influence of the seasonal daily light-dark rhythms. Pronounced differences between WATs and CATs (independent t-test; confidence level, P<0.01) were found in the central area of the spinal gray matter and in the ependymal epithelium lining the brain ventricles. Forebrain regions (DC, MC and

Dien) also revealed significant differences between WATs and CATs (independent t-test; confidence level, P<0.01-0.05). Unexplored biological clocks that may be affecting cell proliferation were equalized by performing paired experiments involving one WAT and one CAT. Both animals were injected on the same day at the same time and both were sacrificed 24 h later. These experiments confirmed that a warm environment increased cell proliferation in the CNS of turtles. Double- and triple-labeling experiments involving anti-BrdU antibody together with anti-glial protein antibodies revealed that temperature modulates not only cell populations expressing glial markers but also other cells that do not express them. As expected, in the case of short post-injection (BrdU) surviving time points, no cells were found colabeling for BrdU and NeuN (neuronal marker). The probable direct effect of temperature on the cell division rate should be analyzed together with potential indirect effects involving increased motor activity and increased food intake. The fate of the increased BrdU-LCs (death, permanence as progenitor cells or differentiation following neuronal or glial lines) remains a matter for further investigation. Results are discussed in the light of current opinions concerned with post-natal neurogenesis in vertebrates.
Descriptors: reptiles, juvenile turtles, environmental temperature, affects, cell proliferation, spinal cord, brain.

Ray, P.P. and B.R. Maiti (2003). **Interrenal responses to high ambient temperature in soft-shelled turtle, *Lissemys punctata punctata.*** *Indian Journal of Experimental Biology* 41(8): 880-884. ISSN: 0019-5189.
NAL Call Number: 442.8 IN2
Abstract: An exposure to ambient temperature of 25 degrees C had no perceptible effect on interrenal function but further increase of temperature to 35 degrees C caused nuclear hypertrophy with increase of nuclear diameter, RNA concentration, acid phosphatase and alkaline phosphatase activities, accompanied by quantitative depletions of cholesterol (free, esterified and total) and ascorbic acid levels in the interrenal gland of the soft-shelled turtle *Lissemys p. punctata*. Similar manifestations of stimulation, except in the nucleus, were marked after exposure to 38 degrees C, but the degree of response in respect of esterified and free cholesterol levels was higher at 38 degrees C than at 35 degrees C. Moreover, withdrawal of 38 degrees C temperature and subsequently maintaining at 25 degrees C for 15 days showed reverse manifestations to those of 35 degrees C/38 degrees C, leading to a tendency towards normalcy. It is suggested that high a ambient temperature of 35 degrees C significantly stimulates interrenal function of Lissemys turtles, but further increase of 38 degrees C does not cause further overall stimulation, and withdrawal of higher temperature (38 degrees C) shows a tendency towards normalcy. It is also suggested that (a) high ambient temperature causes thermal stress, (b) it is reversible and (c) it acts on interrenal activity presumably via CRF-ACTH-axis in turtles.
Descriptors: reptiles, soft-shelled turtle, *Lissemys p. punctata*, high ambient temperature, internal response, thermal stress.

Ray, P.P. and B.R. Maiti (2003). **Interrenal responses to high ambient temperature in soft-shelled turtle, *Lissemys punctata punctata.*** *Indian Journal of Experimental Biology* 41(8): 880-884. ISSN: 0019-5189.

NAL Call Number: 442.8 IN2
Descriptors: reptiles, soft shelled turtle, *Lissemys punctata punctata*, high ambient temperature, interrenal responses.

Rhen, T. and J.W. Lang (2004). **Phenotypic effects of incubation temperature in reptiles.** In: N. Valenzuela and V. Lance (Editors), *Temperature Dependent Sex Determination in Vertebrates,* Smithsonian Books: Washington, DC, p. 90-98. ISBN: 1588342034.
NAL Call Number: QP278.5 .T45 2004
Descriptors: reptiles, sex determination, temperature dependent.

Robert, K.A., M.B. Thompson, and F. Seebacher (2006). **Thermal biology of a viviparous lizard with temperature-dependant sex determination.** *Journal of Thermal Biology* 31(4): 292-301. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: reptiles, viviparous lizard, thermal biology, sex determination, temperature dependant.

Row, J.R. and G. Blouin Demers (2006). **Thermal quality influences effectiveness of thermoregulation, habitat use, and behaviour in milk snakes.** *Oecologia* 148(1): 1-11. ISSN: print: 0029-8549; online: 1432-1939.
NAL Call Number: QL750.O3
Abstract: We investigated the link between thermal quality and the effectiveness of thermoregulation in milk snakes in a thermally challenging environment. We defined thermoregulatory effectiveness as the extent to which an individual maintains its body temperature (Tb) closer to the preferred range (Tset) than allowed by the thermal quality of its environment. We defined thermal quality as the magnitude of the difference between operative environmental temperatures (Te) and Tset. Because ectotherms regulate body temperatures through choice of habitat and behavioural adjustments, we also examined the link between thermoregulation, habitat use and behaviour. During 2003-2004, we located 25 individuals 890 times, and recorded their Tb. Thermal quality was lower in the spring and fall than in the summer, and was lower in forests than in open habitats. Milk snakes thermoregulated more effectively in the spring than in the summer and fall, and more effectively in the forest than in open habitats. Milk snakes had a strong preference for open habitats in all seasons, which was likely to facilitate behavioural thermoregulation. The preference for open habitats was equally strong in all seasons and, therefore, the higher effectiveness of thermoregulation was not a result of altered habitat use. Instead, milk snakes modified their behaviour and were seen basking more and moved less in the spring than in the summer.
Descriptors: reptiles, milk snakes, thermal quality, thermoregulation, habitat use, behavior, effectiveness, body temperature, ectotherms.

Sears, M.W. (2005). **Geographic variation in the life history of the sagebrush lizard: the role of thermal constraints on activity.** *Oecologia* 143(1): 25-36. ISSN: print: 0029-8549; online: 1432-1939.
NAL Call Number: QL750.O3

Abstract: Thermal constraints on the time available for activity have been proposed as a proximate mechanism to explain variation in suites of life history traits. The longer that an ectotherm can maintain activity, the more time it has to forage and the greater chance that it will encounter a predator and be eaten. Thus, the thermal environment may produce a trade off between growth and survival when variation in the environment favors increased activity. I used mark-recapture data from a demographic study of three natural populations of the sagebrush lizard (*Sceloporus graciosus*) and estimates of thermal opportunity for each population to evaluate whether variation in the thermal environment can explain patterns of growth and survival that occur over an elevational gradient. Lizards from the highest elevation population exhibited higher individual growth rates than those of lizards from lower elevation, while mortality rates increased with elevation for these populations. The covariation of fast growth and high mortality with increased thermal opportunity is the opposite trend expected if the thermal environment alone is to explain patterns of life history in these lizards. Additional factors including thermal heterogeneity in the distribution of microhabitats of lizards, adaptation to local environmental conditions, and a potential trade-off between resource acquisition and predation risk need to be addressed to obtain a satisfactory explanation of the causative mechanisms producing life history variation.
Descriptors: lizards, thermal constraints, activity , ectotherm, thermal environment, patterns of growth, survival, predation risk.

Seebacher, F. (2005). **A review of thermoregulation and physiological performance in reptiles: what is the role of phenotypic flexibility?** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 175(7): 453-461. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: Biological functions are dependent on the temperature of the organism. Animals may respond to fluctuation in the thermal environment by regulating their body temperature and by modifying physiological and biochemical rates. Phenotypic flexibility (reversible phenotypic plasticity, acclimation, or acclimatisation in rate functions occurs in all major taxonomic groups and may be considered as an ancestral condition. Within the Reptilia, representatives from all major groups show phenotypic flexibility in response to long-term or chronic changes in the thermal environment. Acclimation or acclimatisation in reptiles are most commonly assessed by measuring whole animal responses such as oxygen consumption, but whole animal responses are comprised of variation in individual traits such as enzyme activities, hormone expression, and cardiovascular functions. The challenge now lies in connecting the changes in the components to the functioning of the whole animal and its fitness. Experimental designs in research on reptilian thermal physiology should incorporate the capacity for reversible phenotypic plasticity as a null-hypothesis, because the significance of differential body temperature-performance relationships (thermal reaction norms) between individuals, populations, or species cannot be assessed without testing that null-hypothesis.
Descriptors: reptiles, body temperature regulation, physiology, fluctuations, thermal environment, acclimatization, oxygen consumption, review.

Seebacher, F., R.M. Elsey, and P.L.3. Trosclair (2003). **Body temperature null distributions in reptiles with nonzero heat capacity: seasonal thermoregulation in the American alligator (*Alligator mississippiensis*).** *Physiological and Biochemical Zoology* 76(3): 348-359. ISSN: 1522-2152.

NAL Call Number: QL1.P52

Abstract: Regulation of body temperature may increase fitness of animals by ensuring that biochemical and physiological processes proceed at an optimal rate. The validity of current methods of testing whether or not thermoregulation in reptiles occurs is often limited to very small species that have near zero heat capacity. The aim of this study was to develop a method that allows estimation of body temperature null distributions of large reptiles and to investigate seasonal thermoregulation in the American alligator (*Alligator mississippiensis*). Continuous body temperature records of wild alligators were obtained from implanted data-loggers in winter (n=7, mass range: 1.6-53.6 kg) and summer (n=7, mass range: 1.9-54.5 kg). Body temperature null distributions were calculated by randomising behavioural postures, thereby randomly altering relative animal surface areas exposed to different avenues of heat transfer. Core body temperatures were predicted by calculations of transient heat transfer by conduction and blood flow. Alligator body temperatures follow regular oscillations during the day. Occasionally, body temperature steadied during the day to fall within a relatively narrow range. Rather than indicating shuttling thermoregulation, however, this pattern could be predicted from random movements. Average daily body temperature increases with body mass in winter but not in summer. Daily amplitudes of body temperature decrease with increasing body mass in summer but not in winter. These patterns result from differential exposure to heat transfer mechanisms at different seasons. In summer, alligators are significantly cooler than predictions for a randomly moving animal, and the reverse is the case in winter. Theoretical predictions show, however, that alligators can be warmer in winter if they maximised their sun exposure. We concluded that alligators may not rely exclusively on regulation of body temperature but that they may also acclimatise biochemically to seasonally changing environmental conditions.

Descriptors: reptiles, American alligator, body temperature , seasonal thermoregulation, nonzero heat capacity, *Alligator mississippiensis.*

Seebacher, F. and C.E. Franklin (2005). **Physiological mechanisms of thermoregulation in reptiles: a review.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 175(8): 533-541. ISSN: print: 0174-1578; online: 1432-136X.

NAL Call Number: QP33.J681

Abstract: The thermal dependence of biochemical reaction rates means that many animals regulate their body temperature so that fluctuations in body temperature are small compared to environmental temperature fluctuations. Thermoregulation is a complex process that involves sensing of the environment, and subsequent processing of the environmental information. We suggest that the physiological mechanisms that facilitate thermoregulation transcend phylogenetic boundaries. Reptiles are primarily used as model organisms for ecological and evolutionary research and, unlike in mammals, the physiological basis of many aspects in thermoregulation remains obscure. Here, we review recent research on regulation of body temperature, thermoreception, body temperature set-points, and cardiovascular

control of heating and cooling in reptiles. The aim of this review is to place physiological thermoregulation of reptiles in a wider phylogenetic context. Future research on reptilian thermoregulation should focus on the pathways that connect peripheral sensing to central processing which will ultimately lead to the thermoregulatory response.
Descriptors: reptiles, thermoregulation, mechanisms, body temperature, biochemical reaction rates, physiology, review.

Seebacher, F. and C.E. Franklin (2004). **Integration of autonomic and local mechanisms in regulating cardiovascular responses to heating and cooling in a reptile (*Crocodylus porosus*).** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 174(7): 577-585. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Abstract: Reptiles change heart rate and blood flow patterns in response to heating and cooling, thereby decreasing the behavioural cost of thermoregulation. We tested the hypothesis that locally produced vasoactive substances, nitric oxide and prostaglandins, mediate the cardiovascular response of reptiles to heat. Heart rate and blood pressure were measured in eight crocodiles (*Crocodylus porosus*) during heating and cooling and while sequentially inhibiting nitric-oxide synthase and cyclooxygenase enzymes. Heart rate and blood pressure were significantly higher during heating than during cooling in all treatments. Power spectral density of heart rate and blood pressure increased significantly during heating and cooling compared to the preceding period of thermal equilibrium. Spectral density of heart rate in the high frequency band (0.19-0.70 Hz) was significantly greater during cooling in the saline treatment compared to when nitric-oxide synthase and cyclooxygenase enzymes were inhibited. Cross spectral analysis showed that changes in blood pressure preceded heart rate changes at low frequencies (< 0.1 Hz) only. We conclude that the autonomic nervous system controls heart rate independently from blood pressure at higher frequencies while blood pressure changes determine heart rate at lower frequencies. Nitric oxide and prostaglandins do not control the characteristic heart rate hysteresis response to heat in *C. porosus*, although nitric oxide was important in buffering blood pressure against changes in heart rate during cooling, and inhibition caused a compensatory decrease in parasympathetic stimulation of the heart.
Descriptors: reptiles, crocodile, *Crocodylus porosus*, heating, cooling, cardiovascular responses, heart rate, blood flow, thermoregulation, blood pressure.

Seebacher, F. and C.E. Franklin (2003). **Prostaglandins are important in thermoregulation of a reptile (*Pogona vitticeps*).** *Proceedings of the Royal Society of London. Series B, Biological Sciences* 270(Suppl 1): S50-S53. ISSN: print: 0962-8452; online: 1471-2945.
Abstract: The effectiveness of behavioural thermoregulation in reptiles is amplified by cardiovascular responses, particularly by differential rates of heart beat in response to heating and cooling (heart-rate hysteresis). Heart-rate hysteresis is ecologically important in most lineages of ectothermic reptile, and we demonstrate that heart-rate hysteresis in the lizard *Pogona vitticeps* is mediated by prostaglandins. In a control treatment (administration of saline), heart rates during heating were significantly faster than during cooling at any given body temperature. When cyclooxygenase 1 and 2 enzymes were inhibited, heart rates during

heating were not significantly different from those during cooling. Administration of agonists showed that thromboxane B(2) did not have a significant effect on heart rate, but prostacyclin and prostaglandin F(2alpha) caused a significant increase (3.5 and 13.6 beats min(-1), respectively) in heart rate compared with control treatments. We speculate that heart-rate hysteresis evolved as a thermoregulatory mechanism that may ultimately be controlled by neurally induced stimulation of nitric oxide production, or maybe via photolytically induced production of vitamin D.
Descriptors: reptiles, *Pogona vitticeps*, thermoregulation, prostaglandins, cardiovascular responses, heart beat, heating, cooling.

Seebacher, F. and R. Shine (2004). **Evaluating thermoregulation in reptiles: the fallacy of the inappropriately applied method.** *Physiological and Biochemical Zoology* 77(4): 688-695. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Given the importance of heat in most biological processes, studies on thermoregulation have played a major role in understanding the ecology of ectothermic vertebrates. It is, however, difficult to assess whether body temperature is actually regulated, and several techniques have been developed that allow an objective assessment of thermoregulation. Almost all recent studies on reptiles follow a single methodology that, when used correctly, facilitates comparisons between species, climates, and so on. However, the use of operative temperatures in this methodology assumes zero heat capacity of the study animals and is, therefore, appropriate for small animals only. Operative temperatures represent potentially available body temperatures accurately for small animals but can substantially overestimate the ranges of body temperature available to larger animals whose slower rates of heating and cooling mean that they cannot reach equilibrium if they encounter operative temperatures that change rapidly through either space or time. This error may lead to serious misinterpretations of field data. We derive correction factors specific for body mass and rate of movement that can be used to estimate body temperature null distributions of larger reptiles, thereby overcoming this methodological problem.
Descriptors: reptiles, thermoregulation, evaluating, studies, body temperature, heating, cooling, small animals, large animals, applied method.

Seebacher, F., J. Sparrow, and M.B. Thompson (2004). **Turtles (*Chelodina longicollis*) regulate muscle metabolic enzyme activity in response to seasonal variation in body temperature.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 174(3): 205-210. ISSN: print: 0174-1578; online: 1432-136X.
NAL Call Number: QP33.J681
Descriptors: reptiles, turtles, *Chelodina longicollis*, muscle metabolic enzyme activity, regulate, body temperature, seasonal variation.

Shanbhag, B.A., S.K. Saidapur, and R.S. Radder (2003). **Lowering body temperature induces embryonic diapause during prolonged egg retention in the lizard, *Calotes versicolor*.** *Die Naturwissenschaften* 90(1): 33-35. ISSN: print: 0028-1042; online: 1432-1904.
Abstract: The lizard *Calotes versicolor* delays oviposition of oviductal eggs for as long as 6

months or more under unfavourable conditions. During this period of prolonged egg retention, the growth of oviductal embryos is arrested at stage 34. The present study shows for the first time among reptiles that the "embryonic diapause" is manifested by the gravid females by lowering their body temperature (T(b)) by 3-5 degrees C during the period of egg retention by mechanism(s) presently unknown.
Descriptors: reptiles, lizard, *Calotes versicolor*, prolonged egg retention, body temperature, lowering, embryonic diapause.

Shen, J.M., R.D. Li, and F.Y. Gao (2005). **Effects of ambient temperature on lipid and fatty acid composition in the oviparous lizards, *Phrynocephalus przewalskii.*** *Comparative Biochemistry and Physiology. Part B, Biochemistry and Molecular Biology* 142(3): 293-301. ISSN: 1096-4959.
Abstract: This study was designed to assess the effect of ambient temperature on lipid content, lipid classes and fatty acid compositions of heart, liver, muscle and brain in oviparous lizards, *Phrynocephalus przewalskii*, caught in the desert area of China. Significant differences could be observed in the contents of the total lipid and fatty acid compositions among different temperatures (4, 25 and 38 degrees C). The study showed that liver and muscle were principal sites of lipid storage. Triacylglycerol (TAG) mainly deposited in the liver, while phospholipids (PL) was identified as the predominant lipid class in the muscle and brain. Palmitic and stearic acid generally occupied the higher proportion in saturated fatty acids (SFA), while monounsaturated fatty acids (MUFAs) and polyunsaturated fatty acids (PUFAs) consisted mainly of 16:1n-7, 18:1n-9, 18:2n-6, 18:3n-3, 20:4n-6 and 22:6n-3 regardless of tissue and temperature. These predominant fatty acids proportion fluctuations caused by temperature affected directly the ratio of unsaturated to saturated fatty acids. There was a tendency to increase the degree of unsaturation in the fatty acids of TAG and PL as environmental temperature dropped from 38 to 4 degrees C, although the different extent in different tissues. These results suggested that lipid characteristics of *P. przewalskii* tissues examined were influenced by ambient temperature.
Descriptors: lizards, *Phrynocephalus przewalskii*, ambient temperature, effects, lipid content, fatty acid, composition, heart, liver muscle, brain.

Southwood, A.L., R.D. Andrews, F.V. Paladino, and D.R. Jones (2005). **Effects of diving and swimming behavior on body temperatures of pacific leatherback turtles in tropical seas.** *Physiological and Biochemical Zoology* 78(2): 285-297. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: Mathematical models and recordings of cloacal temperature suggest that leatherback turtles (*Dermochelys coriacea*) maintain core body temperature higher than ambient water temperature (T(W)) while freely swimming at sea. We investigated the thermoregulatory capabilities of free-ranging leatherbacks and, specifically, the effect that changes in diving patterns and ambient temperatures have on leatherback body temperatures (T(B)). Data loggers were used to record subcarapace and gastrointestinal tract temperatures (T(SC) and T(GT), respectively), T(W), swim speed, dive depth, and dive times of female leatherback turtles during internesting intervals off the coast of Guanacaste, Costa Rica. Mean T(SC) (28.7 degrees -29.0 degrees C) was significantly higher than mean T(W) (25.0 degrees -27.5

degrees C). There was a significant positive relationship between T(SC) and T(W) and a significant negative correlation between T(SC) and dive depth and T(GT) and dive depth. Rapid fluctuations in T(GT) occurred during the first several days of the internesting interval, which suggests that turtles were ingesting prey or water during this time. Turtles spent 79%-91% of the time at sea swimming at speeds greater than 0.2 m s(-1), and the average swim speed was 0.7 +/- 0.2 m s(-1). Results from this study show that alterations in diving behavior and T(W) affect T(B) of leatherback turtles in the tropics. Body temperatures of free-ranging leatherback turtles correspond well with values for T(B) predicted by mathematical models for tropical conditions.
Descriptors: leatherback turtle, *Dermochelys coriacea*, diving, swimming, behavior, body temperature, effects, thermoregulatory capabilities , mathematical models.

Southwood, A.L., C.A. Darveau, and D.R. Jones (2003). **Metabolic and cardiovascular adjustments of juvenile green turtles to seasonal changes in temperature and photoperiod.** *Journal of Experimental Biology* 206(24): 4521-4531. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.00689
NAL Call Number: 442.8 B77
Descriptors: repetiles, juvenile green turtles, temperature changes, photoperiod, metabolic, cardiovascular, adjustments.

Souza, F.L. and F.I. Martins (2006). **Body temperature of free-living freshwater turtles, *Hydromedusa maximiliani* (Testudines, Chelidae)**. *Amphibia Reptilia* 27(3): 464-468. ISSN: 0173-5373.
Descriptors: reptiles, freshwater turtles, *Hydromedusa maximiliani*, free living, body temperature, water temperature, body size, Brazil.

Stawski, C.Y., G.C. Grigg, D.T. Booth, and L.A. Beard (2006). **Temperature and the respiratory properties of whole blood in two reptiles, *Pogona barbata* and *Emydura signata*.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 143(2): 173-183. ISSN: 1095-6433.
Abstract: We investigated the capacity of two reptiles, an agamid lizard *Pogona barbata* and a chelid turtle *Emydura signat*a, to compensate for the effects of temperature by making changes in their whole blood respiratory properties. This was accomplished by measuring the P50 (at 10, 20 and 30 degrees C), hematocrit (Hct), haemoglobin concentration ([Hb]) and mean cell haemoglobin concentration (MCHC) in field acclimatised and laboratory acclimated individuals. The acute effect of temperature on P50 in *P. barbata*, expressed as heat of oxygenation (deltaH), ranged from -16.8+/-1.84 to -28.5+/-2.73 kJ/mole. P50 of field acclimatised *P. barbata* increased significantly from early spring to summer at the test temperatures of 20 degrees C (43.1+/-1.2 to 48.8+/-2.1 mmHg) and 30 degrees C (54.7+/-1.2 to 65.2+/-2.3 mmHg), but showed no acclimation under laboratory conditions. For *E. signata*, deltaH ranged from -31.1+/-6.32 to -48.2+/-3.59 kJ/mole. Field acclimatisation and laboratory acclimation of P50 did not occur. However, in *E. signata*, there was a significant increase in [Hb] and MCHC from early spring to summer in turtles collected from the wild (1.0+/-0.1 to 1.7+/-0.2 mmol/L and 4.0+/-0.3 to 6.7+/-0.7 mmol/L, respectively).

Descriptors: reptiles, turtle, *Emydura signata*, lizard, *Pogona barbata*, temperature, respiratory properties, whole blood, acclimation.

Stinner, J.N. and J.H. Spencer (2003). **Temperature and acid-base status in box turtles.** *FASEB Journal* 17(4-5): Abstract No. 87.1. ISSN: 0892-6638.
NAL Call Number: QH301.F3
Descriptors: reptiles, box turtles, tempersture, acid base status, meeting abstracts.
Notes: Meeting Information: FASEB Meeting on Experimental Biology: Translating the Genome, San Diego, CA, USA; April 11-15, 2003.

Storey, K.B. (2006). **Reptile freeze tolerance: metabolism and gene expression.** *Cryobiology* 52(1): 1-16. ISSN: 0011-2240.
Abstract: Terrestrially hibernating reptiles that live in seasonally cold climates need effective strategies of cold hardiness to survive the winter. Use of thermally buffered hibernacula is very important but when exposure to temperatures below 0 degrees C cannot be avoided, either freeze avoidance (supercooling) or freeze tolerance strategies can be employed, sometimes by the same species depending on environmental conditions. Several reptile species display ecologically relevant freeze tolerance, surviving for extended times with 50% or more of their total body water frozen. The use of colligative cryoprotectants by reptiles is poorly developed but metabolic and enzymatic adaptations providing anoxia tolerance and antioxidant defense are important aids to freezing survival. New studies using DNA array screening are examining the role of freeze-responsive gene expression. Three categories of freeze responsive genes have been identified from recent screenings of liver and heart from freeze-exposed (5h post-nucleation at -2.5 degrees C) hatchling painted turtles, *Chrysemys picta marginata*. These genes encode (a) proteins involved in iron binding, (b) enzymes of antioxidant defense, and (c) serine protease inhibitors. The same genes were up-regulated by anoxia exposure (4 h of N2 gas exposure at 5 degrees C) of the hatchlings which suggests that these defenses for freeze tolerance are aimed at counteracting the injurious effects of the ischemia imposed by plasma freezing.
Descriptors: reptiles, painted turtles, *Chrysemys picta marginata*, body temperature, regulation physiology, cold, gene expression, physiology, antioxidants physiology, freezing, hibernation.

Sun, P., X. Xu, H. Chen, and X. Ji (2002). **[Thermal tolerance, diel variation of body temperature, and thermal dependence of locomotor performance of hatchling soft-shelled turtles, *Trionyx sinensis*]**. *Ying Yong Sheng Tai Xue Bao. [Journal of Applied Ecology]* 13(9): 1161-1165. ISSN: 0021-8901.
Abstract: The thermal tolerance, body temperature, and influence of temperature on locomotor performance of hatchling soft-shelled turtles (*Trionyx sinensis*) were studied under dry and wet conditions, and the selected body temperature of hatchlings was 28.0 and 30.3 degrees C, respectively. Under wet condition, the critical thermal maximum and minimum averaged 40.9 and 7.8 degrees C, respectively. In the environments without thermal gradients, the diel variation of body temperature was highly consistent with the variation of both air and water temperatures, and the body temperature was more directly affected by water

temperature than by air temperature, which implied that the physiological thermoregulation of hatchling *T. sinensis* was very weak. In the environments with thermal gradients, hatchling turtles could maintain relatively high and constant body temperatures, primarily through behavioral thermoregulation. The locomotor performance of hatchling turtles was highly dependent on their body temperature. Within a certain range, the locomotor performance increased with increasing body temperature. In our study, the optimal body temperature for locomotor performance was 31.5 degrees C, under which, the maximum continuous running distance, running distance per minute, and number of stops per minute averaged 1.87 m, 4.92 m.min-1, and 6.2 times.min-1, respectively. The correspondent values at 33.0 degrees C averaged 1.30 m, 4.28 m.min-1, and 7.7 times.min-1, respectively, which indicated that the locomotor performance of hatchling turtles was impaired at 33.0 degrees C. Therefore, extremely high body temperatures might have an adverse effect on locomotor performance of hatchling turtles.
Descriptors: reptiles, shelled turtles, *Trionyx sinensis*, body temperature physiology, motor activity physiology, turtles physiology, body temperature regulation, cold, heat, water.
Language of Text: Chinese.

Talent, L.G. (2005). **Effect of temperature on toxicity of a natural pyrethrin pesticide to green anole lizards (*Anolis carolinensis*).** *Environmental Toxicology and Chemistry* 24(12): 3113-3116. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Abstract: Metabolic rates of reptiles vary with body temperature; therefore, the sensitivity of reptiles to a particular dose level of a pesticide might be expected to vary as well. The purpose of the present study was twofold: To evaluate the effects of temperature on the toxicity to green anole lizards (*Anolis carolinensis*) of a single concentration of a natural pyrethrin pesticide via percutaneous exposure, and to compare the effects of temperature (20 vs 35 degrees C) on the toxicity of different concentrations of pyrethrins to green anoles. When lizards were exposed to a solution that contained 300 mg/L of pyrethrins, the mortality of lizards maintained at 15 and 20 degrees C was significantly higher ($p < 0.01$) than the mortality of lizards maintained at 35 and 38 degrees C. In addition, the median lethal concentrations of pyrethrins for lizards maintained at 20 and 35 degrees C were 77.6 and greater than 300 mg/L, respectively. Therefore, temperature clearly influenced the sensitivity of lizards to pyrethrin pesticides.
Descriptors: lizards, *Anolis carolinensis*, pesticides toxicity, pyrethrins toxicity, temperature, effect, pesticide, metabolic rates, reptiles, sensitivity.

Tanaka, K. (2005). **Thermal aspects of melanistic and striped morphs of the snake *Elaphe quadrivirgata*.** *Zoological Science* 22(11): 1173-1179. ISSN: 0289-0003.
NAL Call Number: QL1.Z68
Abstract: Temperature is a critical factor limiting various aspects of the biology of ectotherms. In addition to environmental factors, coloration and body size are two physical properties that influence ectotherms' body temperature (T(b)). I compared the influences of these properties on thermal aspects of the two morphs of the color-dimorphic snake (*E. quadrivirgata*) under experimental conditions. First, I fitted T(b) data during heating to the

von Bertalanffy equation, but considered parameter values of the equilibrium temperature obtained to be biologically meaningless. Alternatively, I limited the data for comparison of the morphs to T(b) < or =35 degrees C, which was the T(b) at which snakes began to move vigorously in the experiment. The rate of T(b) increase was significantly greater in the melanistic morph than in the striped morph. Heating rate was negatively correlated with body size in both morphs. The interaction of body size and heating rate did not significantly differ between the two morphs. The possibility of linkage, due to thermal advantage, between small body size and the prevalence of melanism in the population studied is briefly discussed. Rapid increase of T(b) is biologically advantageous because snakes with such ability would be released from various time and environmental constraints associated with thermoregulation under particular environmental conditions.
Descriptors: snake, *Elaphe quadrivirgata*, body size, body temperature physiology, melanistic, morphs, striped, pigmentation physiology, time factors, Japan.

Tattersall, G.J., V. Cadena, and M.C. Skinner (2006). **Respiratory cooling and thermoregulatory coupling in reptiles**. *Respiratory Physiology and Neurobiology* 154(1-2): 302-318. ISSN: 1569-9048.
NAL Call Number: QP121.A1 R4
Descriptors: reptiles, respiratory cooling, thermoregulatory coupling, breathing, body temperature, head-body temperature differences.

Toledo, L.F., A.S. Abe, and D.V. Andrade (2003). **Temperature and meal size effects on the postprandial metabolism and energetics in a boid snake.** *Physiological and Biochemical Zoology* 76(2): 240-246. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: We investigated the combined effect of meal size and temperature on the aerobic metabolism and energetics of digestion in *Boa constrictor amarali.* Oxygen uptake rates (Vd2;o2) and the duration of the digestion were determined in snakes fed with meals equaling to 5%, 10%, 20%, and 40% of the snake's body mass at 25 degrees and 30 degrees C. The maximum Vd2;o2 values attained during digestion were greater at 30 degrees C than at 25 degrees C. Both maximal Vd2;o2 values and the duration of the specific dynamic action (SDA) were attained sooner at 30 degrees C than at 25 degrees C. Therefore, the temperature effect on digestion in Boa is characterized by the shortening of the SDA duration at the expense of increased Vd2;o2. Energy allocated to SDA was not affected by meal size but was greater at 25 degrees C compared to 30 degrees C. This indicates that a postprandial thermophilic response can be advantageous not only by decreasing the duration of digestion but also by improving digestive efficiency. Maximal Vd2;o2 and SDA duration increased with meal size at both temperatures.
Descriptors: reptiles, boid snake, *Boa constrictor amarali*, temperature, meal size, effects, postprandial metabolism, energetics.

Vallone, D., E. Frigato, C. Vernesi, A. Foa, N.S. Foulkes, and C. Bertolucci (2007). **Hypothermia modulates circadian clock gene expression in lizard peripheral tissues.** *American Journal of Physiology. Regulatory, Integrative and Comparative Physiology* 292(1): R160-R166. ISSN:

print: 0363-6119; online: 1422-1490.
Online: http://dx.doi.org/10.1152/ajpregu.00370.2006
Abstract: The molecular mechanisms whereby the circadian clock responds to temperature changes are poorly understood. The ruin lizard *Podarcis sicula* has historically proven to be a valuable vertebrate model for exploring the influence of temperature on circadian physiology. It is an ectotherm that naturally experiences an impressive range of temperatures during the course of the year. However, no tools have been available to dissect the molecular basis of the clock in this organism. Here, we report the cloning of three lizard clock gene homologs (Period2, Cryptochrome1, and Clock) that have a close phylogenetic relationship with avian clock genes. These genes are expressed in many tissues and show a rhythmic expression profile at 29 degrees C in light-dark and constant darkness lighting conditions, with phases comparable to their mammalian and avian counterparts. Interestingly, we show that at low temperatures (6 degrees C), cycling clock gene expression is attenuated in peripheral clocks with a characteristic increase in basal expression levels. We speculate that this represents a conserved vertebrate clock gene response to low temperatures. Furthermore, these results bring new insight into the issue of whether circadian clock function is compatible with hypothermia.
Descriptors: reptiles, lizard, *Podarcis sicula*, circadian clock, hypothermia, modulates, gene expression, peripheral tissues, temperature changes.

Vladimirova, I.G., T.A. Alekseeva, and M.V. Nechaeva (2005). [**Effect of temperature on the rate of oxygen consumption during the second half of embryonic and early postembryonic development of European pond turtle *Emys orbicularis* (Reptilia: Emydidae)**]. *Izvestiia Akademii Nauk. Seriia Biologicheskaia Rossiiskaia Akademiia Nauk*(5): 585-591. ISSN: 1026-3470.
Abstract: Oxygen consumption by eggs of European pond turtle was determined at two constant incubation temperatures of 25 and 28 degrees C during the second half of embryogenesis. During development at both temperatures, the rate of oxygen consumption initially increased to remain constant during the last quarter of embryogenesis. The difference between the rates of oxygen consumption at these temperatures decreased during the studied period. The coefficient Q10 for the rate of oxygen consumption decreased from 9 to 1.7. At an incubation temperature of 28 degrees C, the changes in the rate of oxygen consumption in response to a short-term temperature decrease to 25 degrees C or increase to 30 degrees C depended on the developmental stage and were most pronounced at the beginning of the studied period. During late embryonic and first 2.5 months of postembryonic development, the rate of oxygen consumption did not significantly differ after such temperature changes. The regulatory mechanisms formed during embryonic development are proposed to maintain the level of oxygen consumption during temperature changes.
Descriptors: pond turtle, *Emys orbicularis*, temperature, turtles embryology, growth, development, oxygen consumption, eggs, turtles metabolism.
Language of Text: Russian.

Voituron, Y., S. Servais, C. Romestaing, T. Douki, and H. Barre (2006). **Oxidative DNA damage and antioxidant defenses in the European common lizard (*Lacerta vivipara*) in supercooled and frozen states.** *Cryobiology* 52(1): 74-82. ISSN: 0011-2240.

Abstract: The European common lizard (*Lacerta vivipara*) tolerates long periods at sub-zero temperatures, either in the supercooled or the frozen state. Both physiological conditions limit oxygen availability to tissues, compelling lizards to cope with potential oxidative stress during the transition from ischemic/anoxic conditions to reperfusion with aerated blood during recovery. To determine whether antioxidant defenses are implicated in the survival of lizards when facing sub-zero temperatures, we monitored the activities of antioxidant enzymes and oxidative stress either during supercooling or during freezing exposures (20 h at -2.5 degrees C) and 24 h after thawing in two organs of lizards--muscle and liver. Supercooling induced a significant increase in the total SOD and GPx activity in muscle (by 67 and 157%, respectively), but freezing had almost no effect on enzyme activity, either in muscle or in liver. By contrast, thawed lizards exhibited higher GPx activity in both organs (a 133% increase in muscle and 59% increase in liver) and a significant decrease in liver catalase activity (a 47% difference between control and thawed lizards). These data show that supercooling (but not freezing) triggers activation of the antioxidant system and this may be in anticipation of the overgeneration of oxyradicals when the temperature increases (while thawing or at the end of supercooling). Oxidative stress was assessed from the content of 8-oxodGuo and the different DNA adducts resulting from lipid peroxidation, but it was unaltered whatever the physiological state of the lizards, thus demonstrating the efficiency of the antioxidant system that has been developed by this species. Overall, antioxidant defenses appear to be part of the adaptive machinery for reptilian tolerance to sub-zero temperatures.

Descriptors: lizard, *Lacerta vivipara*, antioxidants, pharmacology, DNA damage, drug effects, lizards metabolism, oxidative stress, adaptation, metabolism, freezing, lipid peroxidation, liver metabolism, muscles metabolism, oxidative stress physiology.

Voituron, Y., J.M. Storey, C. Grenot, and K.B. Storey (2002). **Freezing survival, body ice content and blood composition of the freeze-tolerant European common lizard, *Lacerta vivipara*.** *Journal of Comparative Physiology. B, Biochemical, Systemic, and Environmental Physiology* 172(1): 71-76. ISSN: print: 0174-1578; online: 1432-136X.

NAL Call Number: QP33.J681

Abstract: To investigate the freeze tolerance of the European common lizard, *Lacerta vivipara*, we froze 17 individuals to body temperatures as low as -4 degrees C under controlled laboratory conditions. The data show that this species tolerates the freezing of 50% of total body water and can survive freezing exposures of at least 24-h duration. Currently, this represents the best known development of freeze tolerance among squamate reptiles. Freezing stimulated a significant increase in blood glucose levels (16.15+/- 1.73 micromol x ml(-1) for controls versus 25.06 +/- 2.92 micromol x ml(-1) after thawing) but this increase had no significant effect on serum osmolality which was unchanged between control and freeze-exposed lizards (506.0 +/- 23.8 mosmol x l(-1) versus 501.0 +/- 25.3 mosmol x l(-1), respectively). Tests that assessed the possible presence of antifreeze proteins in lizard blood were negative. Recovery at 5 degrees C after freezing was assessed by measurements of the mean time for the return of breathing (5.9 +/- 0.5 h) and of the righting reflex (44.8 +/- 4.5 h). Because this

species hibernates in wet substrates inoculative freezing may frequently occur in nature and the substantial freeze tolerance of this lizard should play a key role in its winter survival.
Descriptors: reptiles, European common lizard, *Lacerta vivipara*, freezing survival, body ice, blood composition, freeze tolerant, serum osmolality, breathing.

Voituron, Y., B. Verdier, and C. Grenot (2002). **The respiratory metabolism of a lizard (*Lacerta vivipara*) in supercooled and frozen states.** *American Journal of Physiology. Regulatory, Integrative and Comparative Physiology* 283(1): R181-R186. ISSN: print: 0363-6119; online: 1522-1490.
Online: http://dx.doi.org/10.1152/ajpregu.00378.2001
Abstract: We investigated the respiratory metabolism of the overwintering lizard *Lacerta vivipara* while in either supercooled or frozen states. With a variable pressure and volume microrespirometer and a chromatograph, we show that the oxygen consumption of the supercooled animals showed a nonlinear relationship with temperature and an aerobic metabolism demand between 0.5 and -1.5 degrees C. A significant increase in the respiratory quotient (RQ) values indicated an increasing contribution by the anaerobic pathways with decreasing temperature. In the frozen state, two phases are easily detectable and are probably linked to the ice formation within the body. During the first 5-6 h, the animals showed an oxygen consumption of 3.52 +/- 0.28 microl. g(-1). h(-1) and a RQ value of 0.52 +/- 0.09. In contrast, after ice equilibrium, oxygen consumption decreased sharply (0.55 +/- 0.09 microl. g(-1). h(-1)) and the RQ values increased (2.49 +/- 0.65). The present study confirms the fact that supercooled invertebrates and vertebrates respond differently to subzero temperatures, in terms of aerobic metabolism, and it shows that aerobic metabolism persists under freezing conditions.
Descriptors: reptiles, lizard, *Lacerta vivipara*, cold, freezing, lizards metabolism, respiratory system metabolism, anaerobiosis, oxygen consumption, pulmonary gas exchange.

Voituron, Y. (2005). **La tolerance au froid chez les reptiles. [Cold tolerance in reptiles.]**. *Bulletin De La Societe Herpetologique De France* 113-114: 53-68. ISSN: 0754-9962.
Descriptors: reptiles, cold tolerance, arctic regions, freezing, mechanisms.
Language of Text: French; Summary in English and French.

Wang Hua, Wang Zheng Huan, Wang Zhen Wei, Gong Jin Nan, and Wang Xiao Ming (2006). **Study on behavioral thermoregulation of Chinese alligator under artificial feeding condition**. *Chinese Journal of Zoology* 41(6): 60-66. ISSN: 0250-3263.
Descriptors: reptiles, Chinese alligator, behavioral thermoregulation, artificial feeding condition.
Language of Text: Chinese.

Wapstra, E., M. Olsson, R. Shine, A. Edwards, R. Swain, and J.M. Joss (2004). **Maternal basking behaviour determines offspring sex in a viviparous reptile.** *Proceedings of the Royal Society of London. Series B, Biological Sciences* 271(Suppl. 4): S230-S232. ISSN: 0080-4649.
Abstract: Two primary dichotomies within vertebrate life histories involve reproductive mode (oviparity versus viviparity) and sex determination (genotypic sex determination versus

environmental sex determination). Although reptiles show multiple evolutionary transitions in both parameters, the co-occurrence of viviparity and environmental-dependent sex determination have heretofore been regarded as incompatible. Our studies on the viviparous lizard *Niveoscincus ocellatus* show that the extent of basking by a female influences the sex of her offspring. Critically, our data reveal this effect both in the field (via correlations between date of birth and litter sex ratio) and in a laboratory experiment (females with reduced basking opportunities produced more male offspring). Changes in thermoregulatory behaviour thus allow pregnant female lizards to modify the sex of their offspring.
Descriptors: reptiles, viviparous lizard, *Niveoscincus ocellatus*, maternal basking, offspring sex, sex determination, thermoregulatory behavior.

Warner, D.A. and R. Shine (2005). **The adaptive significance of temperature-dependent sex determination: experimental tests with a short-lived lizard.** *Evolution International Journal of Organic Evolution* 59(10): 2209-2221. ISSN: print: 0014-3820; online: 1558-5646 .
NAL Call Number: 443.8 Ev62
Abstract: Why is the sex of many reptiles determined by the temperatures that these animals experience during embryogenesis, rather than by their genes? The Charnov-Bull model suggests that temperature-dependent sex determination (TSD) can enhance maternal fitness relative to genotypic sex determination (GSD) if offspring traits affect fitness differently for sons versus daughters and nest temperatures either determine or predict those offspring traits. Although potential pathways for such effects have attracted much speculation, empirical tests largely have been precluded by logistical constraints (i.e., long life spans and late maturation of most TSD reptiles). We experimentally tested four differential fitness models within the Charnov-Bull framework, using a short-lived, early-maturing Australian lizard (*Amphibolurus muricatus*) with TSD. Eggs from wild-caught females were incubated at a range of thermal regimes, and the resultant hatchlings raised in large outdoor enclosures. We applied an aromatase inhibitor to half the eggs to override thermal effects on sex determination, thus decoupling sex and incubation temperature. Based on relationships between incubation temperatures, hatching dates, morphology, growth, and survival of hatchlings in their first season, we were able to reject three of the four differential fitness models. First, matching offspring sex to egg size was not plausible because the relationship between egg (offspring) size and fitness was similar in the two sexes. Second, sex differences in optimal incubation temperatures were not evident, because (1) although incubation temperature influenced offspring phenotypes and growth, it did so in similar ways in sons versus daughters, and (2) the relationship between phenotypic traits and fitness was similar in the two sexes, at least during preadult life. We were unable to reject a fourth model, in which TSD enhances offspring fitness by generating seasonal shifts in offspring sex ratio: that is, TSD allows overproduction of daughters (the sex likely to benefit most from early hatching) early in the nesting season. In keeping with this model, hatching early in the season massively enhanced body size at the beginning of the first winter, albeit with a significant decline in probability of survival. Thus, the timing of hatching is likely to influence reproductive success in this short-lived, early maturing species; and this effect may well differ between the sexes.
Descriptors: Australian lizard, *Amphibolurus muricatus*, physiological, embryology, sex ratio,

temperature, embryo, physiology, embryonic development, growth, development, reproduction, sex determination, genetics.

Warren, D.E., S.A. Reese, and D.C. Jackson (2006). **Tissue glycogen and extracellular buffering limit the survival of red-eared slider turtles during anoxic submergence at 3 degrees C.** *Physiological and Biochemical Zoology* 79(4): 736-744. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: The goal of this study was to identify the factors that limit the survival of the red-eared slider turtle *Trachemys scripta* during long-term anoxic submergence at 3 degrees C. We measured blood acid-base status and tissue lactate and glycogen contents after 13, 29, and 44 d of submergence from ventricle, liver, carapace (lactate only), and four skeletal muscles. We also measured plasma Ca(2+), Mg(2+), Na(+), K(+), Cl(-), inorganic phosphate (P(i)), lactate, and glucose. After 44 d, one of the six remaining turtles died, while the other turtles were in poor condition and suffered from a severe acidemia (blood pH = 7.09 from 7.77) caused by lactic acidosis (plasma lactate 91.5 mmol L(-1)). An initial respiratory acidosis attenuated after 28 d. Lactate rose to similar concentrations in ventricle and skeletal muscle (39.3-46.1 micromol g(-1)). Liver accumulated the least lactate (21.8 micromol g(-1)), and carapace accumulated the most lactate (68.9 micromol g(-1)). Plasma Ca(2+) and Mg(2+) increased significantly throughout submergence to levels comparable to painted turtles at a similar estimated lactate load. Glycogen depletion was extensive in all tissues tested: by 83% in liver, by 90% in ventricle, and by 62%-88% in muscle. We estimate that the shell buffered 69.1% of the total lactate load, which is comparable to painted turtles. Compared with painted turtles, predive tissue glycogen contents and plasma HCO(-)(3) concentrations were low. We believe these differences contribute to the poorer tolerance to long-term anoxic submergence in red-eared slider turtles compared with painted turtles.
Descriptors: reptiles, painted turtles, red-eared slider turtle, *Trachemys scripta*, anoxic submergence, 3 degrees centigrade, tissue glycogen, extracellular buffering, survival.

Willingham, E.J. (2005). **The effects of atrazine and temperature on turtle hatchling size and sex ratios.** *Frontiers in Ecology and the Environment* 3(6): 309-313. ISSN: 1540-9295.
NAL Call Number: QL540.F76
Descriptors: reptiles, atrazine, temperature, effects, turtle hatchling size, sex ratios, reproduction, tocixity.

Xia, T.S., K.H. Zhou, and J.L. Zhu (2006). **Influence of hibernant temperature on reproduction of Chinese alligator.** *Sichuan Journal of Zoology* 25(2): 398-399. ISSN: 1000-7083.
Descriptors: reptiles, Chinese alligator, hibernant temperature, reproduction, influence.
Language of Text: Chinese; Summary in Chinese and English.

Xu, X.F. and X. Ji (2006). **Ontogenetic shifts in thermal tolerance, selected body temperature and thermal dependence of food assimilation and locomotor performance in a lacertid lizard, *Eremias brenchleyi*.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 143(1): 118-124. ISSN: 1095-6433.
Abstract: We used *Eremias brenchleyi* as a model animal to examine differences in thermal

tolerance, selected body temperature, and the thermal dependence of food assimilation and locomotor performance between juvenile and adult lizards. Adults selected higher body temperatures (33.5 vs. 31.7 degrees C) and were able to tolerate a wider range of body temperatures (3.4-43.6 vs. 5.1-40.8 degrees C) than juveniles. Within the body temperature range of 26-38 degrees C, adults overall ate more than juveniles, and food passage rate was faster in adults than juveniles. Apparent digestive coefficient (ADC) and assimilation efficiency (AE) varied among temperature treatments but no clear temperature associated patterns could be discerned for these two variables. At each test temperature ADC and AE were both higher in adults than in juveniles. Sprint speed increased with increase in body temperature at lower body temperatures, but decreased at higher body temperatures. At each test temperature adults ran faster than did juveniles, and the range of body temperatures where lizards maintained 90% of maximum speed differed between adults (27-34 degrees C) and juveniles (29-37 degrees C). Optimal temperatures and thermal sensitivities differed between food assimilation and sprint speed. Our results not only show strong patterns of ontogenetic variation in thermal tolerance, selected body temperature and thermal dependence of food assimilation and locomotor performance in *E. brenchleyi*, but also add support for the multiple optima hypothesis for the thermal dependence of behavioral and physiological variables in reptiles.

Descriptors: *Eremias brenchleyi*, lizards, physiology, adaptation, body temperature, temperature regulation, digestion, eating, gastrointestinal transit, motor activity, temperature.

Zaar, M., E. Larsen, and T. Wang (2004). **Hysteresis of heart rate and heat exchange of fasting and postprandial savannah monitor lizards (*Varanus exanthematicus*).** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 137(4): 675-682. ISSN: 1095-6433.

Abstract: Reptiles are ectothermic, but regulate body temperatures (T(b)) by behavioural and physiological means. Body temperature has profound effects on virtually all physiological functions. It is well known that heating occurs faster than cooling, which seems to correlate with changes in cutaneous perfusion. Increased cutaneous perfusion, and hence elevated cardiac output, during heating is reflected in an increased heart rate (f(H)), and f(H), at a given T(b), is normally higher during heating compared to cooling ('hysteresis of heart rate'). Digestion is associated with an increased metabolic rate. This is associated with an elevated f(H) and many species of reptiles also exhibited a behavioural selection of higher T(b) during digestion. Here, we examine whether digestion affects the rate of heating and cooling as well as the hysteresis of heart rate in savannah monitor lizards (*Varanus exanthematicus*). Fasting lizards were studied after 5 days of food deprivation while digesting lizards were studied approximately 24 h after ingesting dead mice that equalled 10% of their body mass. Heart rate was measured while T(b) increased from 28 to 38 degrees C under a heat lamp and while T(b) decreased during a subsequent cooling phase. The lizards exhibited hysteresis of heart rate, and heating occurred faster than cooling. Feeding led to an increased f(H) (approximately 20 min(-1) irrespective of T(b)), but did not affect the rate of temperature change during heating or cooling. Therefore, it is likely that the increased blood flows during digestion are distributed exclusively to visceral organs and that the thermal conductance remains unaffected by the elevated metabolic rate during digestion.

Descriptors: reptiles, savannah monitor lizards, *Varanus exanthematicus*, heart rate, heat exchange, fasting, post prandial, body temperature, digestion, cardiac output, heating, cooling.

Zhang, Y.P., Z.C. Pan, and X. Ji (2003). **Thermal tolerance, body temperature, and thermal dependence of locomotor performance of hatchling red-eared slider turtles, *Trachemys scripta elegans*.** *Acta Ecologica Sinica* 23(6): 1048-1056. ISSN: 1000-0933.
Descriptors: reptiles, red-eared slider turtles, *Trachemys scripta elegans*, temperature, thermal tolerance, body temperature, locomotor performance, thermal dependence, hatchling.
Language of Text: Chinese; Summary in Chinese and English.

Zheng, R.Q., W.G. Du, Y.P. Zhang, and Y.X. Bao (2006). **Influence of incubation temperature on embryonic use of energy and mineral metabolism in the Chinese three-keeled pond turtle *Chinemys reevesii*.** *Acta Zoologica Sinica* 52(1): 21-27. ISSN: 0001-7302.
Descriptors: reptiles, pond turtle, *Chinemys reevesii*, incubation temperature, embryonic use of energy, mineral metabolism, influence.
Language of Text: Chinese; Summary in Chinese and English.

Zhu, X.P., Y.L. Chen, C.Q. Wei, Y.H. Liu, and J.F. Giu (2006). **Temperature effects on sex determination in yellow pond turtle (*Mauremys mutica* Cantor).** *Acta Ecologica Sinica* 26(2): 620-625. ISSN: 1000-0933.
Descriptors: reptiles, yellow pond turtle, *Mauremys mutica*, temperature effects, sex determination.
Language of Text: Chinese; Summary in Chinese and English.

Toxicity

de Solla, S.R., P.A. Martin, K.J. Fernie, B.J. Park, and G. Mayne (2006). **Effects of environmentally relevant concentrations of atrazine on gonadal development of snapping turtles (*Chelydra serpentina*).** *Environmental Toxicology and Chemistry* 25(2): 520-526. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Abstract: The herbicide atrazine has been suspected of affecting sexual development by inducing aromatase, resulting in the increased conversion of androgens to estrogens. We used snapping turtles (*Chelydra serpentina*), a species in which sex is dependent on the production of estrogen through aromatase activity in a temperature-dependent manner, to investigate if environmentally relevant exposures to atrazine affected gonadal development. Eggs were incubated in soil to which atrazine was applied at a typical field application rate (3.1 L/ha), 10-fold this rate (31 L/ha), and a control rate (no atrazine) for the duration of embryonic development. The incubation temperature (25 degrees C) was selected to produce only males. Although some males with testicular oocytes and females were produced in the atrazine-treated groups (3.3-3.7%) but not in the control group, no statistical differences were found among treatments. Furthermore, snapping turtle eggs collected from natural nests in a corn field were incubated at the pivotal temperature (27.5 degrees C) at which both males and females normally would be produced, and some males had oocytes in the testes (15.4%). The presence of low numbers of males with oocytes may be a natural phenomenon, and we have limited evidence to suggest that the presence of normal males with oocytes may represent a feminizing effect of atrazine. Histological examination of the thyroid gland revealed no effect on thyroid morphology.
Descriptors: turtles, atrazine toxicity, turtles growth, herbicides toxicity, oocytes growth and development, testis growth and development, turtles growth and development, aromatase biosynthesis, environmental exposure, enzyme induction, estrogens physiology, oocytes drug effects, ovum, temperature, testis cytology, testis drug effects.

Jones, D.E., R.M.J. Gogal, P.B. Nader, and S.D. Holladay (2005). **Organochlorine detection in the shed skins of snakes.** *Ecotoxicology and Environmental Safety* 60(3): 282-287. ISSN: 0147-6513.
NAL Call Number: QH545.A1E29
Abstract: Lizards and snakes eliminate heavy metals in their shed skins. There are no data with regard to reptilian skin as a depuration route for organochlorine (OC) compounds; however, birds deposit OCs in feathers. Corn snakes (*Elaphe guttata*) were therefore fed thawed mice that had been injected with a mixture of alpha-chlordane, Aroclor 1254 (a polychlorinated biphenyl (PCB) mixture), and lindane (gamma-hexachlorocyclohexane) at 2, 8, and 4 mg/kg, respectively. Feeding of contaminated mice occurred on the first weekly feeding of each month, with remaining weekly feedings consisting of noncontaminated mice, and was continued for 6 months. Shed skins were evaluated in a multiresidue OC scan by gas chromatography. All three chemical contaminants were readily detected in the shed skins: chlordane, 0.155-0.213 ppm; PCB, 3.49-7.01 ppm; lindane: 0.028-0.042 ppm. These data

suggest that the shed skin of snakes may serve as an elimination route for OC contaminants and as such may have utility as a noninvasive, nondestructive indicator tissue for assessing environmental contamination.
Descriptors: snakes, environmental monitoring, shed skins, organochlorine detection, lizards, heavy metals, environmental contamination. noninvasive, nondestructive, indicator.

Keller, J.M., J.R. Kucklick, and P.D. McClellan Green (2004). **Organochlorine contaminants in loggerhead sea turtle blood: extraction techniques and distribution among plasma and red blood cells.** *Archives of Environmental Contamination and Toxicology* 46(2): 254-264. ISSN: 0090-4341.
NAL Call Number: TD172.A7
Descriptors: reptiles, sea turtle, *Caretta caretta*, organochlorine compounds, organochlorine pesticides, monitoring, blood plasma, erythrocytes, extraction techniques , plasma, red blood cells.

Marco, A., J. Hidalgo Vila, and C. Diaz Paniagua (2004). **Toxic effects of ammonium nitrate fertilizer on flexible-shelled lizard eggs.** *Bulletin of Environmental Contamination and Toxicology* 73(1): 125-131. ISSN: 0007-4861.
NAL Call Number: RA1270.P35A1
Descriptors: reptiles, ammonium fertilizers, nitrate fertilizers, nitrogen, pollution, lizards, ova, embryo (animal), embryogenesis, embryotoxicity, roots, nitrogen pollution, *Podarcis hispanica*, *Podarcis carbonelli*, egg fertilizer interactions.

Sifuentes Romero, I., C. Vazquez Boucard, A.P. Sierra Beltran, and S.C. Gardner (2006). **Vitellogenin in black turtle (*Chelonia mydas agassizii*): purification, partial characterization, and validation of an enzyme-linked immunosorbent assay for its detection.** *Environmental Toxicology and Chemistry* 25(2): 477-485. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Abstract: Black turtle plasmatic vitellogenin (VTG) was purified from 17beta-estradiol-induced males using ion-exchange chromatography. The isolated protein was identified as VTG by its glycolipoprotein nature and amino acid sequence homology with other vertebrate VTG. It was characterized as a 500-kDa dimer composed of two identical, 200- to 240-kDa monomers. Polyclonal antibodies raised against black turtle VTG showed high titer and specificity, as demonstrated by enzyme-linked immunosorbent assay and Western blot analysis, respectively. The range of the assay was estimated to be between 15 ng/ml and 2 microg/ml, and the inter- and intra-assay coefficients of variation were 9.4 and 7.3%, respectively. Black turtle antibody cross-reacted with VTG of two other sea turtle species, *Caretta caretta* (loggerhead) and *Eretmochelys imbricata* (hawksbill), extending the applicability of the assay as part of a sea turtle health assessment program.
Descriptors: reptiles, vitellogenin, black turtle, *Chelonia mydas agassizii*, loggerhead turtle, *Caretta caretta*, hawksbill turtle, *Eretmochelys imbricata*, enzyme-linked immunosorbent assay, detection, health assessment.

Talent, L.G. (2005). **Effect of temperature on toxicity of a natural pyrethrin pesticide to green anole lizards (*Anolis carolinensis*).** *Environmental Toxicology and Chemistry* 24(12): 3113-3116. ISSN: 0730-7268.

NAL Call Number: QH545.A1E58

Abstract: Metabolic rates of reptiles vary with body temperature; therefore, the sensitivity of reptiles to a particular dose level of a pesticide might be expected to vary as well. The purpose of the present study was twofold: To evaluate the effects of temperature on the toxicity to green anole lizards (*Anolis carolinensis*) of a single concentration of a natural pyrethrin pesticide via percutaneous exposure, and to compare the effects of temperature (20 vs 35 degrees C) on the toxicity of different concentrations of pyrethrins to green anoles. When lizards were exposed to a solution that contained 300 mg/L of pyrethrins, the mortality of lizards maintained at 15 and 20 degrees C was significantly higher ($p < 0.01$) than the mortality of lizards maintained at 35 and 38 degrees C. In addition, the median lethal concentrations of pyrethrins for lizards maintained at 20 and 35 degrees C were 77.6 and greater than 300 mg/L, respectively. Therefore, temperature clearly influenced the sensitivity of lizards to pyrethrin pesticides.

Descriptors: lizards, *Anolis carolinensis*, pesticides toxicity, pyrethrins toxicity, temperature, effect, pesticide, metabolic rates, reptiles, sensitivity.

Talent, L.G., J.N. Dumont, J.A. Bantle, D.M. Janz, and S.G. Talent (2002). **Evaluation of western fence lizards (*Sceloporus occidentalis*) and eastern fence lizards (*Sceloporus undulatus*) as laboratory reptile models for toxicological investigations.** *Environmental Toxicology and Chemistry* 21(5): 899-905. ISSN: 0730-7268.

NAL Call Number: QH545.A1E58

Abstract: A need is recognized for one or more laboratory reptile models for use in ecotoxicological studies and risk assessments. Maintenance of breeding populations of most reptile species under laboratory conditions is not practical because of their size and slow maturation rate. However, a number of species of spiny lizards (*Sceloporus* sp.) are small, mature quickly, and reproduce under laboratory conditions. We evaluated three populations of western fence lizards (*S. occidentalis*) and four populations of eastern fence lizards (*S. undulatus*) for their performance under laboratory conditions. We reared an F1 generation of each population and compared their performance relative to survival, growth, maturation rate, and reproductive output. A population from the San Joaquin Valley (CA. USA) performed especially well under laboratory conditions and is a good candidate for a laboratory model. We also examined the sensitivity of developing fence lizard embryos to an estrogenic chemical to determine if male secondary sex characteristics were affected. Microinjecting eggs with an estrogenic chemical (17alpha-ethinylestradiol) feminized males and prevented development of embryonic secondary sex characteristics. Therefore, embryonic fence lizards may be useful for studying the effects of endocrine-disrupting chemicals.

Descriptors: reptiles, fence lizards, *Sceloporus occidentalis*, *Sceloporus undulatus*, laboratory reptile models , toxicological investigations, pollution, evaluation, risk assessment, embryonic fence lizards.

Ultraviolet Radiation

Baines, F., A. Beveridge, R. Hitch, and R. Lane (2006). **Looking at UVB in a new light: A four-part study of ultraviolet light in reptile husbandry. Part 4: indoor sunshine ... mercury vapour lamps.** *Herptile* 31(1): 4-21. ISSN: 0953-2021.
Descriptors: reptiles, UVB, ultraviolet light, reptile husbandry, study, indoor shushine, mercury vapor lamps.

Baines, F., R. Hitch, and R. Lane (2005). **Looking at the UVB in a new light. A four-part study of ultraviolet light in reptile husbandry.** *Herptile* 30(3): 100-124. ISSN: 0953-2021.
Descriptors: reptiles, UV light, husbandry, ultraviolet light in reptile husbandry, four part study.

Baines, F., R. Hitch, and R. Lane (2005). **Looking at UVB in a new light. A four-part study of ultraviolet light in reptile husbandry.** *Herptile* 30(4): 148-172. ISSN: 0953-2021.
Descriptors: reptiles, UVB, ultraviolet light, reptile husbandry, four part study.

Chang, C. and R. Zheng (2003). **Effects of ultraviolet B on epidermal morphology, shedding, lipid peroxide, and antioxidant enzymes in cope's rat snake (*Elaphe taeniura*).** *Journal of Photochemistry and Photobiology B Biology* 72(1-3): 79-85. ISSN: 1011-1344.
Descriptors: reptiles, rat snakes, ultraviolet B, effects, morphology, shedding, lipid peroxide, antioxident enzymes.

Hibma, J.C. (2004). **Dietary vitamin D3 and UV-B exposure effects on green iguana growth rate: is full-spectrum lighting necessary?** *Bulletin of the Chicago Herpetological Society* 39(8): 145-150. ISSN: 0009-3564.
Descriptors: reptiles, green iguana, dietary vitamin D3, UV-B exposure effects, full spectrum lighting, necessary, growth rate.

Veterinary

Aguirre, A.A., G.H. Balazs, T.R. Spraker, S.K.K. Murakawa, and B. Zimmerman (2002). **Pathology of oropharyngeal fibropapillomatosis in green turtles *Chelonia mydas*.** *Journal of Aquatic Animal Health* 14(4): 298-304. ISSN: 0899-7659.
NAL Call Number: SH171.J68
Descriptors: reptiles, green turtles, fibropapillmatosis, oropharyngeal, veterinary pathology.

Alkindi, A.Y.A. and I.Y. Mahmoud (2002). **A new method of sampling arterial blood from large sea turtles.** *Herpetological Review* 33(4): 281-282. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, large sea turtles, arterial blood, sampling, new method.

Alleman, A.R. and E.K. Kupprion (2007). **Cytologic diagnosis of diseases in reptiles.** *Veterinary Clinics of North America, Exotic Animal Practice* 10(1): 155-186. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: The cytologic evaluation of samples obtained from reptile patients may provide invaluable diagnostic information to the clinician. The following article is directed toward providing information regarding the techniques used to obtain samples, discussion of sample types, and guidelines for the cytologic classification of the materials collected from tissue lesions and body fluids.
Descriptors: reptiles, cytodiagnosis, veterinary, animal diseases, samples, techniques, guidelines, tissue lesions, body fluids.

Baines, F.M. and R.R. Davies (2004). **The euthanasia of reptiles.** *Herptile* 29(2): 60-71. ISSN: 0953-2021.
Descriptors: reptiles, euthanasia, methods, techniques , efficacy, humane.

Barten, S.L. (2002). **Ventral midline mini-debate: in support of paramedian celiotomy incisions in lizards.** *Proceedings of the North American Veterinary Conference.* 16(16): 903. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, lizards, surgery, paramedian celiotomy incision, ventral mid-line, debate, conference proceedings.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida.

Barten, S.L. (2002). **Diseases of the Iguana oral cavity.** *Proceedings of the North American Veterinary Conference* 16(16): 894-895. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: iguana, mouth diseases, oral cavity, reptiles, conference proceedings.

Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Baur, M., E. Haertl, R.W. Hoffmann, and F. Weber (2004). **Die Kastration maennlicher Gruener Leguane, *Iguana iguana* Indikationen, Tierschutzrelevanz, Vorgehen. [Castration in male green iguanas.]**. *Tieraerztliche Umschau* 59(2): 113-114, 117-120. ISSN: 0049-3864.
Descriptors: reptiles, green iguanas, *Iguana iguana*, captive animals, castration, reasons, surgical techniques, male, procedure.
Language of Text: German; Summary in English and German.

Bennett, R.A. (2004). **Radiografia en reptiles: tecnicas e interpretacion. [Radiography in reptiles: techniques and interpretation].** *Proceedings of the North American Veterinary Conference* 18: 1468-1470. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, radiography, techniques, veterinary interpretation, conference proceedings , book.
Language of Text: Spanish.
Notes: In the volume: Small Animal and Exotics Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Bennett, R.A. (2004). **Sujecion y examen en reptiles. [Handling and examination of reptiles].** *Proceedings of the North American Veterinary Conference* 18: 1461-1464. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, handling and examination, conference proceedings, book chapter.
Language of Text: Spanish.
Notes: In the volume: Small Animal and Exotics Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Benson, K.G., L.A. Tell, L.A. Young, S. Wetzlich, and A.L. Craigmill (2003). **Pharmacokinetics of ceftiofur sodium after intramuscular or subcutaneous administration in green iguanas (*Iguana iguana*).** *American Journal of Veterinary Research* 64(10): 1278-1282. ISSN: 0002-9645.
NAL Call Number: 41.8 Am3A
Abstract: OBJECTIVE: To determine the pharmacokinetics of ceftiofur sodium after IM and SC administration in green iguanas. ANIMALS: 6 male and 4 female adult green iguanas. PROCEDURE: In a crossover design, 5 iguanas received a single dose of ceftiofur sodium (5 mg/kg) IM, and 5 iguanas received the same dose SC. Blood samples were taken at 0, 20, and 40 minutes and 1, 2, 4, 8, 24, 48, and 72 hours after administration. After a 10-week washout period, each iguana was given the same dose via the reciprocal administration route, and blood was collected in the same fashion. Ceftiofur free-acid equivalents were measured via high-performance liquid chromatography. RESULTS: The first phase intercepts were significantly different between the 2 administration routes. Mean maximum plasma concentration was significantly higher with the IM (28.6 +/- 8.0 microg/mL) than the SC (18.6 +/- 8.3 microg/mL) administration route. There were no significant differences

between terminal half-lives (harmonic mean via IM route, 15.7 +/- 4.7 hours; harmonic mean via SC route, 19.7 +/- 6.7 hours) and mean areas under the curve measured to the last time point (IM route, 11,722 +/- 7,907 microg x h/mL; SC route, 12,143 +/- 9,633 microg x h/mL). Ceftiofur free-acid equivalent concentrations were maintained > or = 2 microg/mL for > 24 hours via both routes. CONCLUSIONS AND CLINICAL RELEVANCE: A suggested dosing schedule for ceftiofur sodium in green iguanas for microbes susceptible at > 2 microg/mL would be 5 mg/kg, IM or SC, every 24 hours.
Descriptors: reptiles, green iguanas, ceftiofur sodium, pharmacokinetics, administration, intramuscular, subcutaneous, blood samples, dosing schedule.

Beregi, A., V. Molnar, Z. Lukacs, and F. Baska (2003). **Coelotomische Entfernung eines Angelhakens aus einer Sumpfschildkrote (*Emys orbicularis*).[Celiotomic removal of a fishing hook in a European mud turtle (*Emys orbicularis*)].** *Kleintierpraxis* 48(1): 41-45. ISSN: 0023-2076.
NAL Call Number: SF981.K573
Descriptors: reptiles, European mud turtle, *Emys orbicularis*, fishing hook, celiotomic removal, surgery, case study.
Language of Text: German; Summary in English.

Beregi, A., V. Molnar, J. Szabo, G. Kiss, F. Felkai, and G. Fancsi (2003). **A kigyok es a gyikok rontgendiagnosztikai vizsgalata. 2. A radiologiai vizsgalatok indikacioi, a koros elvaltozasok rontgenleletei. [Diagnostic radiology of snakes and lizards. 2. Indication of radiological examination and radiograps of pathological lesions.].** *Magyar Allatorvosok Lapja* 125(3): 159-164. ISSN: 0025-004X.
Descriptors: reptiles, snakes, lizards, radiological examination, diagnostic radiology, radiographs, pathological lesions, veterinary procedure.
Language of Text: Hungarian.

Beregi Attila, Molnar Viktor, Szabo Judit, Kiss Gabor, Felkai Ferenc, and Fancsi Gabor (2003). **A kigyok es a gyikok rontgendiagnosztikai vizsgalata. 1. A felvetel elkeszitesenek technikaja, a kigyok es a gyikok rontgenanatomiaja. [Diagnostic radiology of snakes and lizards. 1. Radiographic technique and radiographs of healthy snakes and lizards.].** *Magyar Allatorvosok Lapja* 125(1): 49-53. ISSN: 0025-004X.
Descriptors: reptiles, snakes, lizards, diagnostic radiology, radiographic technique, radiographs, veterinary proceedures.
Language of Text: Hungarian.

Boyer, T.H. (2006). **Common procedures with venomous reptiles.** *Veterinary Clinics of North America, Exotic Animal Practice* 9(2): 269-285. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Venomous reptiles should be handled in a safe and consistent manner, even after death. Owners and staff should be warned not to handle the venomous reptile, and one should have emergency protocols in place before the properly bagged and encased reptile is presented. It is important to know what one is treating as well as one's limitations. After

being carefully removed from the bag, the venomous reptile may be transferred to a handling container, tubed, or squeezed with the appropriate equipment. The author usually induces injectable or gas anesthesia at this point. Veterinarians who are inexperienced with venomous reptiles should learn how to handle them through a reputable seminar or class before electing to see them in their practice.

Descriptors: venomous reptiles, bites and stings prevention and control, clinical competence, reptiles, snake venoms adverse effects, snakes, veterinary medicine.

Bradley Bays, T.A. (2005). **Equipping the reptile practice.** *Veterinary Clinics of North America, Exotic Animal Practice* 8(3): 437-461. ISSN: 1094-9194.

NAL Call Number: SF997.5.E95 E97

Abstract: Reptile medicine and surgery has advanced so much in the last 15 years, and clients are becoming increasingly aware of the needs of their reptile pets. As such, it is important for veterinary practitioners to advance their education in reptile medicine if they intend to add reptiles as patients to their clinics. Equally important is to realize one's limitations and to not only know when it is time to refer but to find out which practices near them are the best prepared for referral of these unique pets.

Descriptors: reptiles, anatomy, histology, physiology, surgery, veterinary medicine, instrumentation, methods, standards, animals, clinical competence, physical examination, veterinary professional competence.

Brosnan, R.J., B.H. Pypendop, L.S. Barter, and M.G. Hawkins (2006). **Pharmacokinetics of inhaled anesthetics in green iguanas (*Iguana iguana*).** *American Journal of Veterinary Research* 67(10): 1670-1674. ISSN: 0002-9645.

NAL Call Number: 41.8 Am3A

Descriptors: reptiles, green iguanas, *Iguana iguana*, inhaled anesthetics, pharmacokinetics.

Brown, D.R., D.L. Demcovitz, D.R. Plourde, S.M. Potter, M.E. Hunt, R.D. Jones, and D.S. Rotstein (2006). ***Mycoplasma iguanae* sp. nov., from a green iguana (*Iguana iguana*) with vertebral disease.** *International Journal of Systematic and Evolutionary Microbiology* 56(Pt 4): 761-764. ISSN: print: 1466-5026; online: 1466-5034.

Abstract: Strain 2327T, first cultured from vertebral abscesses of green iguanas (*Iguana iguana*) collected in Florida, USA, was readily distinguished from all previously described mollicutes by 16S rRNA gene sequence comparisons. Strain 2327T lacks a cell wall, ferments glucose, does not hydrolyse arginine, aesculin or urea and is sensitive to digitonin. Western blots distinguished the novel isolate serologically from the most closely related members of the Mycoplasma neurolyticum cluster. On the basis of these data, the isolate represents a novel species for which the name Mycoplasma iguanae sp. nov. is proposed. The type strain is strain 2327T (=ATCC BAA-1050T = NCTC 11745T).

Descriptors: *Iguana iguana*, iguanas microbiology, mycoplasma infections, molecular sequence data, phylogeny, ribosomal RNA, genetics, DNA sequence analysis.

Brown, D.R., J.L. Merritt, E.R. Jacobson, P.A. Klein, J.G. Tully, and M.B. Brown (2004). ***Mycoplasma testudineum* sp. nov., from a desert tortoise (*Gopherus agassizii*) with upper respiratory tract disease**. *International Journal of Systematic and Evolutionary Microbiology* 54(5): 1527-1529. ISSN: print: 1466-5026; online: 1466-5034.
Descriptors: reptiles, desert tortoise, *Mycoplasma testudineum* sp., upper respiratory tract disease, *Gopherus agassizii.*

Brown, J.D., J.M. Richards, J. Robertson, S. Holladay, and J.M. Sleeman (2004). **Pathology of aural abscesses in free-living Eastern box turtles (*Terrapene carolina carolina*).** *Journal of Wildlife Diseases* 40(4): 704-712. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Abstract: Aural abscess or abscess of the middle ear is common in free-living Eastern box turtles (*Terrapene carolina carolina*) of Virginia (USA) and elsewhere. Although its etiology remains unknown, hypovitaminosis A has been suggested on the basis of similar lesions occurring in captive chelonians fed diets that are deficient in vitamin A. This hypothesis was supported by significantly greater body burdens of organochlorine compounds (reported disruptors of vitamin A metabolism) and a nonsignificant trend toward lower serum and hepatic vitamin A levels in free-living box turtles with this lesion. The tympanic epithelium was evaluated in 27 box turtles (10 with aural abscesses and 17 without). Lesions of the tympanic epithelium of box turtles with aural abscesses included hyperplasia, squamous metaplasia, hyperemia, cellular sloughing, granulomatous inflammation, and bacterial infection. These changes were more severe in turtles with aural abscesses than in those without and were more severe in tympanic cavities that had an abscess compared to those without when the lesion was unilateral. Organs from 21 box turtles (10 with aural abscesses and 11 without) from the study population were examined for microscopic lesions, and minimal histopathologic changes were found, none of which were similar to those found in the tympanic epithelium. Histopathologic changes in box turtles with aural abscesses were consistent with a syndrome that may involve hypovitaminosis A.
Descriptors: reptiles, Eastern box turtle, free living, aural abscesses, middle ear, hypovitaminosis A, deficient diet, chelonians, histopathologic changes.

Buenviaje, G.N., J.M. Millan, P.M. Summers, and R.G. Hirst (2004). **Use of copper sulphate for the treatment of dermatophilosis ('brown spot' disease) in farmed crocodiles.** *Australian Veterinary Journal* 82(9): 577-578. ISSN: 0005-0423.
NAL Call Number: 41.8 Au72
Descriptors: reptiles, crocodiles, alternative livestock, animal diseases, skin diseases , copper sulfate, drug therapy, *Dermatophilus*, bacterial infections, formaldehyde, *Crocodylus porosus*, drug evaluation, skin lesions, mycoses, mixed infection, dermatophilosis.

Bulte, G., C. Verly, and G. Blouin Demers (2006). **An improved blood sampling technique for hatchling emydid turtles**. *Herpetological Review* 37(3): 318-319. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, emydid turtles, hatchling, improved blood sampling technique.

Burridge, M. (2005). **Controlling and eradicating tick infestations on reptiles.** *Compendium on Continuing Education for the Practicing Veterinarian* 27(5): 371-375. ISSN: 0193-1903.
NAL Call Number: SF601.C66
Descriptors: reptiles, disease transmission, acaricides, permethrin, tick control, Florida, eradicating, infestations.

Carter, S.L., B.D. Horne, D.W. Herman, D.K. Nichols, C.A. Haas, and J.C. Mitchell (2005). **Bacterial pneumonia in free-ranging bog turtles, *Glyptemys muhlenbergii* , from North Carolina and Virginia.** *Journal of the North Carolina Academy of Science* 121(4): 170-173.
NAL Call Number: Q11 .J6817
Descriptors: reptiles, bog turtles, free ranging, *Glyptemys muhlenbergii*, bacterial pneumonia, case report, North Carolina, Virginia.

Casal, A.B. and J. Oros (2007). **Morphologic and cytochemical characteristics of blood cells of juvenile loggerhead sea turtles (*Caretta caretta*).** *Research in Veterinary Science* 82(2): 158-165. ISSN: 0034-5288.
Abstract: A morphologic classification based on the cytochemical characteristics of blood cells of 35 juvenile loggerhead sea turtles (*Caretta caretta*) is described. Cytochemical stains included benzidine peroxidase, chloroacetate esterase, alpha-naphthyl butyrate esterase (with and without sodium fluoride), acid phosphatase (with and without tartaric acid), Sudan black B, periodic acid-Schiff, and toluidine blue. The morphologic characteristics of erythrocytes were similar to those reported in green turtles. Six types of white blood cells were identified: heterophils, eosinophils, basophils, lymphocytes, monocytes and thrombocytes. Except for the basophils, the rest of the white blood cells from loggerhead turtles had different cytochemical characteristics compared to blood cells from other sea turtle species. The leukocyte differential count was different from that reported for other sea turtle species. Heterophils were the most numerous leukocytes from these loggerhead turtles, followed by lymphocytes, eosinophils, monocytes and basophils. This paper provides a morphologic classification of blood cells of loggerhead sea turtles that is useful for veterinary surgeons involved in sea turtle conservation.
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, blood cells, cytochemical characteristics, morphological, juvenile, veterinary medicine.

Casimire Etzioni, A.L., J.F.X. Wellehan, J.E. Embury, S.P. Terrell, and R.E. Raskin (2004). **Synovial fluid from an African spur-thighed tortoise (*Geochelone sulcata*)**. *Veterinary Clinical Pathology* 33(1): 43-46. ISSN: 0275-6382.
NAL Call Number: SF601.A54
Descriptors: reptiles, tortoise, *Geochelone sulcata*, synovial fluid, arthrocentesis, case reports, diagnosis, gout, cytologic evaluation.

Chittick, E.J., M.A. Stamper, J.F. Beasley, G.A. Lewbart, and W.A. Horne (2002). **Medetomidine, ketamine, and sevoflurane for anesthesia of injured loggerhead sea turtles: 13 cases (1996-2000).** *Journal of the American Veterinary Medical Association* 221(7): 1019-1025. ISSN: 0003-1488.

NAL Call Number: 41.8 Am3

Abstract: OBJECTIVE: To determine safety and efficacy of an anesthetic protocol incorporating medetomidine, ketamine, and sevoflurane for anesthesia of injured loggerhead sea turtles. DESIGN: Retrospective study. ANIMALS: 13 loggerhead sea turtles. PROCEDURE: Anesthesia was induced with medetomidine (50 microg/kg [22.7 microg/lb], IV) and ketamine (5 mg/kg (2.3 mg/lb], IV) and maintained with sevoflurane (0.5 to 2.5%) in oxygen. Sevoflurane was delivered with a pressure-limited intermittent-flow ventilator. Heart rate and rhythm, end-tidal partial pressure of CO2, and cloacal temperature were monitored continuously; venous blood gas analyses were performed intermittently. Administration of sevoflurane was discontinued 30 to 60 minutes prior to the end of the surgical procedure. Atipamezole (0.25 mg/kg [0.11 mg/lb], IV) was administered at the end of surgery. RESULTS: Median induction time was 11 minutes (range, 2 to 40 minutes; n = 11). Median delivered sevoflurane concentrations 15, 30, 60, and 120 minutes after intubation were 2.5 (n = 12), 1.5 (12), 1.25 (12), and 0.5% (8), respectively. Heart rate decreased during surgery to a median value of 15 beats/min (n = 11). End-tidal partial pressure of CO2 ranged from 2 to 16 mm Hg (n = 8); median blood gas values were within reference limits. Median time from atipamezole administration to extubation was 14 minutes (range, 2 to 84 minutes; n = 7). CONCLUSIONS AND CLINICAL RELEVANCE: Results suggest that a combination of medetomidine and ketamine for induction and sevoflurane for maintenance provides safe, effective, controllable anesthesia in injured loggerhead sea turtles.

Descriptors: reptiles, loggerhead sea turtles, anesthesia, medetomidine, ketamine, sevoflurane, drug combination, induction, maintenance.

Colitz, C.M., G. Lewbart, and M.G. Davidson (2002). **Phacoemulsification in an adult Savannah monitor lizard.** *Veterinary Ophthalmology* 5(3): 207-209. ISSN: 1463-5216.

NAL Call Number: SF891.V47

Abstract: An adult male Savannah monitor lizard (*Varanus exanthematicus*) was presented for bilateral lens opacities that had progressed rapidly over the previous 2 months. A diagnosis of bilateral mature cataracts was made and phacoemulsification cataract extraction was performed. Surgery restored vision and normal activity to the patient.

Descriptors: reptiles, male Savannah monitor lizard (*Varanus exanthematicus*), cataract, phacoemulsification, cataract diagnosis, cataract pathology, diagnosis, cataract extraction, case study.

Notes: In the special issue: Exotic and laboratory animal / edited by T.J. Kern.

Cooper, J.E. (2003). **Skin diseases of reptiles**. *Veterinary Times* 33(23): 12-13. ISSN: 1352-9374.

Descriptors: reptiles, skin diseases, abscesses, dermatitis, diagnosis, ectoparasites, treatment, neoplasms, lesions.

Cousquer, G. (2006). **Handling and restraint of exotic patients - Part 2: Reptiles and amphibians**. *VN Times* 6(12): 18-19. ISSN: 0922-8012.

Descriptors: handling, amphibians, reptiles, methodology, pets, restraint of animals, techniques, lizards, reptiles, snakes, tortoises.

Croft, L.A., J.P. Graham, S.A. Schaf, and E.R. Jacobson (2004). **Evaluation of magnetic resonance imaging for detection of internal tumors in green turtles with cutaneous fibropapillomatosis.** *Journal of the American Veterinary Medical Association* 225(9): 1428-1435. ISSN: 0003-1488.

NAL Call Number: 41.8 Am3

Abstract: OBJECTIVE: To describe the gross cross-sectional anatomy of green turtles (*Chelonia mydas*) and evaluate magnetic resonance imaging (MRI) for detection of internal tumors in green turtles with cutaneous fibropapillomatosis. DESIGN: Prospective study. ANIMALS: 3 dead green turtles, 1 healthy green turtle, and 8 green turtles with cutaneous fibropapillomatosis. PROCEDURES: Gross cross-sectional anatomy of a dead turtle was described. Each live turtle underwent a complete physical examination, and dorsoventral whole-body survey radiographic views were obtained. Magnetic resonance imaging was performed in dorsal and transverse planes. Radiographs and magnetic resonance images were examined for evidence of internal nodules. Results were compared with necropsy findings in 5 of 8 turtles. RESULTS: Nodules in the lungs of 2 turtles were detected via radiography, whereas pulmonary nodules were detected in 5 turtles via MRI. No other visceral nodules were detected via radiography; however, masses in the stomach and adjacent to the bladder and kidneys were detected in 1 turtle via MRI. Other extrapulmonary abnormalities observed at necropsy were not detected on MR images. CONCLUSIONS AND CLINICAL RELEVANCE: MRI may be valuable for detection of internal tumors in green turtles with cutaneous fibropapillomatosis. Nodules were more apparent in the lungs than in other organs. Results of MRI may serve as prognostic indicators for sea turtles undergoing assessment, treatment, and rehabilitation. Clinical application may be limited by cost and availability of MRI technology.

Descriptors: reptiles, green turtles, internal tumors, fibropapillomatosis, magnetic resonance imaging, MRI, evaluation, cross sectional anatomy.

D' Agostino, C., A. Lanza, C. Nannetti, G.M. Damiani, C. Tarantino, and S. Perrucci (2003). **Criptosporidiosi nei rettili. [Cryptosporidiosis in reptiles].** *Obiettivi e Documenti Veterinari* 24(2): 43-46. ISSN: 0392-1913.

Descriptors: reptiles, snake, lizard, turtles, cryptosporidosis , diagnosis, fecal exam, *Cryptosporidium serpentis*, *C. saurophylum*, disease.

Language of Text: Italian.

Davis, J.R. and D.F. Denardo (2007). **The urinary bladder as a physiological reservoir that moderates dehydration in a large desert lizard, the Gila monster *Heloderma suspectum*.** *Journal of Experimental Biology.* 210(Pt 8): 1472-1480. ISSN: 0022-0949.

Online: http://dx.doi.org/10.1242/jeb.003061

NAL Call Number: 442.8 B77

Abstract: Animals inhabiting xeric environments use a variety of behavioral and physiological strategies to balance water budgets. We studied the potential contribution of the urinary bladder to osmoregulation in a large desert lizard, the Gila monster *Heloderma suspectum*. Here we present results of a series of in vivo laboratory experiments which tested the hypothesis that the Gila monster urinary bladder serves as a physiological reservoir, as in amphibians

and chelonians, providing water that buffers increases in plasma osmolality when food and water are unavailable. Adult Gila monsters absorbed water from the urinary bladder into circulation and absorption of water from the urinary bladder and drinking water provided similar osmoregulatory benefits within 24 h, although drinking water provided a more immediate osmotic benefit. During food and water deprivation, plasma osmolality increased 2.5 times faster in lizards with an empty urinary bladder compared with those with a full bladder. During rehydration, stereotyped binge drinking behavior increased body mass nearly 22%, which resulted in a 24% reduction in plasma osmolality and a substantial increase in bladder water within 24 h. These results support our hypothesis and demonstrate for the first time in an adult lizard that the urinary bladder can function as a long-term physiological water reservoir. This trait can provide a critical benefit to osmoregulation during the 2- to 3-month summer dry season characteristic of the deserts that Gila monsters inhabit.
Descriptors: reptiles, lizards, Gila monster, urinary bladder, water budgets, osmoregulation, dehydration, physiological reservoir, plasma osmality.

De Voe, R., K. Geissler, S. Elmore, D. Rotstein, G. Lewbart, and J. Guy (2004). **Ranavirus-associated morbidity and mortality in a group of captive eastern box turtles (*Terrapene carolina carolina*).** *Journal of Zoo and Wildlife Medicine* 35(4): 534-543. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Abstract: Seven captive eastern box turtles (*Terrapene carolina carolina*) from a large collection of North American chelonians in North Carolina became acutely ill in the fall of 2002. Five of the turtles died. Clinical signs included cutaneous abscessation, oral ulceration or abscessation (or both), respiratory distress, anorexia, and lethargy. The predominant postmortem lesion was fibrinoid vasculitis of various organs, including skin, mucous membranes, lungs, and liver. No inclusion bodies were detected by histopathology or electron microscopy of formalin-fixed tissue. An iridovirus was isolated from tissues obtained postmortem from two of the box turtles that died. The virus was characterized by electron microscopy, polymerase chain reaction, and sequence analysis of a portion of the major capsid protein as a member of the genus Ranavirus.
Descriptors: reptiles, captive eastern box turtles, morbidity, mortality, ranavirus, clinical signs, postmortem lesions, iridovirus, case study.

Deem, S.L., E.S. Dierenfeld, G.P. Sounguet, A.R. Alleman, C. Cray, R.H. Poppeng, T.M. Norton, and W.B. Karesh (2006). **Blood values in free-ranging nesting leatherback sea turtles (*Dermochelys coriacea*) on the coast of the republic of Gabon**. *Journal of Zoo and Wildlife Medicine* 37(4): 464-471. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, leatherback sea turtles, blood values, hematology, plasma biochemistry, plasma protein electrophoresis.

DeNardo, D.F. (2004). **Essentials of reproductive physiology for the reptile practitioner**. *Proceedings of the North American Veterinary Conference* 18: 1333-1334. ISSN: 0341-6593.
NAL Call Number: SF605.N672
Descriptors: reptiles, reproductive physiology, essentials, reptile practitioner, conference

proceedings, book chapter.
Notes: In the volume: Small Animal and Exotics Book Two: Pain Management Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

DeNardo, D.F. (2004). **Stress and its influence on clinical disease in reptiles**. *Proceedings of the North American Veterinary Conference* 18: 1326-1328. ISSN: 0341-6953.
NAL Call Number: SF605.N672
Descriptors: reptiles, stress, influence on clinical disease , restraint.
Notes: In the volume: Small Animal and Exotics Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

DeNardo, D.F. (2004). **Clinical applications in reptile reproduction**. *Proceedings of the North American Veterinary Conference* 18: 1335-1337. ISSN: 0341-6593.
NAL Call Number: SF605.N672
Descriptors: reptiles, clinical applications, reproduction, pregnancy, sex determination, conference proceedings, book chapter.
Notes: In the volume: Small Animal and Exotics Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Di Bello, A., C. Valastro, and F. Staffieri (2006). **Surgical approach to the coelomic cavity through the axillary and inguinal regions in sea turtles.** *Journal of the American Veterinary Medical Association* 228(6): 922-925. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Abstract: OBJECTIVE: To describe a surgical approach to the coelomic cavity through the axillary and inguinal regions in sea turtles. DESIGN: Descriptive report. ANIMALS: 9 loggerhead sea turtles (*Caretta caretta*) that had ingested fishhooks or monofilament fishing line. PROCEDURE: Turtles known to have ingested foreign bodies were anesthetized. For the extraction of fish-hooks located in the stomach, an approach to the coelomic cavity through the soft tissues of the left axillary region (along the cranial margin of the plastron) was made. For the removal of fishhooks and long fishing lines in other portions of the intestinal tract, an approach to the coelomic cavity was performed via the inguinal region. Foreign bodies were removed via gastrotomy or enterotomy. RESULTS: Of the 9 loggerhead turtles, 3 had a fish-hook in the stomach, 1 had a fishhook in the stomach and fishing line throughout the intestinal tract, 2 had a fishhook in the ileum and fishing line in the ileum and colon, and 3 had fishing line throughout the intestinal tract. Following surgery, 8 turtles recovered successfully; 1 turtle (in which an enterectomy was performed) died. After approximately 8 weeks, the surviving turtles were well enough to be released from captivity. CONCLUSIONS AND CLINICAL RELEVANCE: Results indicated that an axillary approach to the coelomic cavity in sea turtles could be a useful alternative to plastron osteotomy. Moreover, the inguinal approach allows the exteriorization of the intestinal tract from jejunum to colon, which facilitates surgical removal of long linear foreign bodies ingested by turtles.
Descriptors: reptiles, sea turtles, *Caretta caretta*, surgical approach, coelomic cavity, axillary, inguinal, region, fishhooks, stomach, ingested foreign bodies.

Di Bello, A., C. Valastro, F. Staffteri, and A. Crovace (2006). **Contrast radiography of the gastrointestinal tract in sea turtles.** *Veterinary Radiology and Ultrasound* 47(4): 351-354. ISSN: 1058-8183.

Abstract: Intestinal obstruction by radiolucent foreign bodies is common in sea turtles. The absence of clinical signs and the extended fasting periods in these animals means that intestinal obstructions may not be diagnosed early. Digestive tract radiographic contrast procedures were performed to evaluate the gastrointestinal transit time and intestinal obstructions in loggerhead sea turtles. Barium sulfate and nonionic iodinate contrast medium were used for radiographic contrast procedures. Contrast medium was administered via a gastric tube or into the colon. These procedures are often necessary and are useful to document intestinal obstruction and foreign objects. The diagnostic procedures were not easily performed in some turtles, but often they were adequate for the diagnosis.

Descriptors: reptiles, sea turtles, gastrointestinal tract, contrast radiography, intestinal obstruction, ingested foreign bodies, clinical signs, barium sulfate.

Eatwell, K. (2003). **The anorexic tortoise: Part 1**. *Veterinary Times* 33(31): 20. ISSN: 1352-9374.

Descriptors: reptiles, tortoises, animal husbandry, anorexia, clinical aspects, diet, hibernation.

Ebani, V.V., D. Cerri, F. Fratini, N. Meille, P. Valentini, and E. Andreani (2005). ***Salmonella enterica* isolates from faeces of domestic reptiles and a study of their antimicrobial in vitro sensitivity.** *Research in Veterinary Science* 78(2): 117-121. ISSN: 0034-5288.

NAL Call Number: 41.8 R312

Abstract: From October 2001 to February 2002, the faecal samples of 305 reptiles (165 saurians, 99 ophidians and 41 chelonians) were bacteriologically examined to detect *Salmonella enterica*. *S. enterica* was isolated from 73 (23.93%) faecal samples including 44 (60.27%) samples collected from saurians, 15 (20.55%) from chelonians and 14 (19.18%) from ophidians; considering the number of samples taken for each reptile group, *S. enterica* was isolated from the 36.58% of chelonians, 26.66% of saurians and 14.14% of ophidians. The isolates were distributed among 38 serotypes. Sixty-nine (94.52%) isolates were resistant to erythromycin. About one-third of the isolates was resistant to sulfisoxazole (35.61%), gentamycin (32.88%), amoxycillin (31.51%) and ampicillin (27.40%). All but one of the isolates were sensitive to chloramphenicol. A high percentages of isolates were sensitive to enrofloxacin (84.93%), nitrofurantoin (80.82%), trimethoprim (76.71%) and tetracycline (75.34%).

Descriptors: reptiles, fecal testing, anti bacterial agents, pharmacology, microbiology, *Salmonella* infections, *Salmonella enterica*, drug effects, sensitivity tests, serotyping, veterinary.

Eggenschwiler, U. (2004). **Respiratory diseases in turtles: recognition, treatment and prevention.** *Reptilia GB* 34: 70-73. ISSN: 1138-4913.

Descriptors: reptiles, turtles, respiratory diseases, recognition, prevention, treatment.

Fertard, B. (2004). **Frattura del carapace in una tartaruga. [Carapace fracture in a tortoise].** *Summa* 21(6): 46-48. ISSN: 0100-5405.
Descriptors: reptiles, tortoise, carapace fracture, veterinary care.
Language of Text: Italian.

Fontenot, D.K., N. Lamberski, and S. Pfaff (2004). **Physical, hematologic, and plasma biochemistry values of five crocodiles monitors, *Varanus salvadorii*.** *Journal of Herpetological Medicine and Surgery* 14(1): 5-9. ISSN: 1529-9651.
NAL Call Number: SF997.5.R4 B85
Descriptors: reptiles, crocodile monitors, *Varanus salvadorii*, blood, physical, hematologic, plasma biochemistry, values, temperature.

French, S.S., K.S. Matt, and M.C. Moore (2006). **The effects of stress on wound healing in male tree lizards (*Urosaurus ornatus*).** *General and Comparative Endocrinology* 145(2): 128-132. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: Exposure to stress can affect an organism's partitioning of resources among immune function and other organismal functions. However, measuring immune function is often difficult. Recent studies show that the rate of cutaneous wound healing in laboratory rodents is a simple, integrated measure of stress-sensitive immune function. We investigated the use of this technique in tree lizards to test the hypotheses (1) that stress compromises wound healing and (2) that this effect is at least partially mediated by corticosterone. Laboratory-housed male tree lizards randomly assigned to the experimental and control treatment groups received a 3.5 mm cutaneous biopsy on the dorsal surface of the pelvis. Experimental group males were restrained in cloth bags for 60 min every day for 21 days during the healing profile, whereas control males were left in their cages. Wound sizes were measured every other day by image analysis. Control animals healed faster than stressed animals. The difference in wound surface area between the groups was most pronounced early in the healing profile. Stressed animals also had higher corticosterone levels and corticosterone was negatively correlated with healing rate in the stressed animals. These observations support both hypotheses that stress compromises healing and that corticosterone may act to mediate the effects of stress.
Descriptors: tree lizards, *Urosaurus ornatus*, corticosterone blood, lizards physiology, stress blood, wound healing physiology, restraint, physical, stress immunology.

Funk, R.S. (2002). **Venomoid surgeries in snakes.** *Proceedings of the North American Veterinary Conference* 16(16): 909. ISSN: 0341-6593.
NAL Call Number: SF605.N672
Descriptors: reptiles, snakes, venoms, surgery, United States, conference proceedings.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Funk, R.S. (2002). **Quarantine procedures and protocol for reptiles.** *Proceedings of the North American Veterinary Conference* 16(16): 907-908. ISSN: 0341-6593.
NAL Call Number: SF605.N672
Descriptors: reptiles, quarantine, procedures, protocol, disease control, parasite control, ticks, *Salmonela*.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Funk, R.S. (2002). **Interpreting reptile lab work.** *Proceedings of the North American Veterinary Conference* 16(16): 905-906. ISSN: 0341-6593.
NAL Call Number: SF605.N672
Descriptors: reptiles, laboratory diagnosis, interpreting lab work, conference proceedings.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Funk, R.S. (2002). **General examination and common diagnostics in reptiles.** *Proceedings of the North American Veterinary Conference* 16(16): 904. ISSN: 0341-6593.
NAL Call Number: SF605.N672
Descriptors: reptiles, clinical examination, tests, diagnosis, common diagnostics.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida.

Funk, R.S. (2002). **Lizard reproductive medicine and surgery.** *Veterinary Clinics of North America, Exotic Animal Practice* 5(3): 579-613. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Lizards are a diverse group of some 4470 species, a wide variety of which are now kept in captivity. Interest in captive lizards continues to increase, wild populations seem to be declining in some areas, and herpetoculturists continue to succeed in breeding more species; consequently, veterinarians must understand basic lizard reproductive biology to successfully treat lizard patients with reproductive problems. Just obtaining First Filial Generation (F1) offspring is an accomplishment. But we must look down the road to maintain a species in captivity for succeeding generations, and a lineage may not continue if attention is not given to details of appropriate husbandry and proper reproductive pursuits. One study documents the senescence of lineages in parthenogenetic lizards in captivity apparently associated with husbandry problems [99].
Descriptors: reptiles, lizards, genital diseases, female , male, lizards physiology, reproduction, prevention, control, genital disease surgery, sexual behavior., captive situations.

Funk, R.S. (2004). **Diagnosing and treating reproductive disorders in snakes.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 35-40. ISSN: 1529-9651.
Online: http://www.arav.org
NAL Call Number: SF996.A77

Descriptors: reptiles, snakes, reproductive disorders, diagnosing, treating, Conference proceedings.

Gaio, C., P. Scarpa, T. Rossi, L. Baggiani, D. Gelli, and E. Ferro (2005). **Urine polyacrylamide gel electrophoresis (SDS-page): preliminary results regarding assessment of proteinuria in the diagnosis of renal damage in reptiles.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 12: 61-64. ISSN: 1529-9651.
Online: http://www.arav.org/
NAL Call Number: SF996.A77
Descriptors: reptiles, renal damage, proteinuria, diagnosis, urine polyacrylamide, gel electrophoresis, assessment, preliminary results, renal disease.

Gal, J., M. Mandoki, C. Jakab, E. Sos, and M. Marosan (2003). **Entamoebosis zold leguanban (*Iguana iguana*).[Entamoebiosis in green iguana (*Iguana iguana*)].** *Magyar Allatorvosok Lapja* 125(7): 422-424. ISSN: 0025-004X.
Descriptors: reptiles, iguana, case reports, entamoebosis, clinical aspects.
Language of Text: Hungarian; Summary in English.

Gal, J., M. Mandoki, E. Sos, and M. Marosan (2004). **Tojasvisszatartas es kovetkezmenyes savosfibrines savoshartya-gyulladas vitorlas agama (*Hydrosaurus amboinensis*) testuregeben. [Egg retention and consequent catarrhal-fibrinoid inflammation of serous membrane in a sailfin lizard's (*Hydrosaurus amboinensis*) abdominal cavity].** *Magyar Allatorvosok Lapja* 126(5): 290-292. ISSN: 0025-004X.
Descriptors: reptiles, sailfin lizard, *Hydrosaurus amboinensis*, egg retention, reproductive disorders, serous membrane, inflammation, abdominal cavity.
Language of Text: Hungarian; Summary in English.

Gal, J., M. Mandoki, Z. Vincze, and E. Sos (2003). **Elhalasos vastagbelgyulladas sarga bikasikloban (*Pituophis catenifer affinis*). [Necrotic colitis in a gopher snake (*Pituophis catenifer affinis*)].** *Magyar Allatorvosok Lapja* 125(6): 379-381 . ISSN: 0025-004X.
Descriptors: reptiles, gopher snake, *Pituophis catenifer affinis*, necrotic colitis.
Language of Text: Hungarian; Summary in English.

Gal, J., E. Sos, L. Mezosi, S. Radvanyi, M. Mandoki, and T. Toth (2006). **Abscess formation caused by *Plesiomonas shigelloides* in the body cavity of the lizard *Ameiva ameiva* (Linnaeus, 1758).** *Salamandra* 42(1): 53-56. ISSN: 0036-3375.
Descriptors: reptiles, lizard, *Amevia amevia*, abcess formation, body cavity, bacteria, *Plesiomonas shigelloides*, chronic inflammation.

Garner, M.M. (2004). **Reptile bone marrow examination and interpretation**. *Exotic DVM* 6(3): 70-74. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, bone marrow, examination, interpretation, blood, conference, veterinary.

Notes: Meeting Information: Sixth Annual International Conference on Exotics, Naples, Florida, USA, 6-8 May 2004.

Garner, M.M. (2003). **Focus on diseases of reptiles**. *Exotic DVM* 5(3): 65-70. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, lizards, snakes, turtles, diseases, conference proceedings.
Notes: Meeting Information: International Conference on Exotics (ICE2003), Palm Beach, Florida, USA, 2003.

Garner, M.M. (2004). **Reptile bone marrow examination and interpretation.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 17-20. ISSN: 1529-9651.
Online: http://www.arav.org/
NAL Call Number: SF996.A77
Descriptors: reptiles, bone marrow, examination, interpretation, evaluation, anatomy , sampling.

Garner, M.M., S.M. Hernandez Divers, and J.T. Raymond (2004). **Reptile neoplasia: a retrospective study of case submissions to a specialty diagnostic service.** *Veterinary Clinics of North America, Exotic Animal Practice* 7(3): vi, 653-671. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Descriptors: reptiles, neoplasia, retrospective study, case submissions, diagnostic service.

Garner, M.M. and J.T. Raymond (2004). **Methods for diagnosing inclusion body disease in snakes.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 21-25. ISSN: 1529-9651.
Online: http://www.arav.org/
NAL Call Number: SF996.A77
Descriptors: reptiles, inclusion body disease, diagnosing, methods, IBD, snakes, liver biopsy.

Geddes, L.A. (2002). **Electrocardiograms from the turtle to the elephant that illustrate interesting physiological phenomena.** *Pacing and Clinical Electrophysiology* 25(12): 1762-1770. ISSN: print: 0147-8389; online: 1540-8159.
Abstract: This article describes a collection of ECGs from many species obtained over the past 50 years. Presented are ECGs of species in which the pacemaker is a separate contractile chamber with its own action and recovery potentials. In such species, pacemaker atrial and AV block can be produced. Shortening of the atrial refractory period and the negative inotropic effect can be produced by vagal stimulation. The cardiac electrogram and stroke volume are recorded from the turtle heart. The ECG and respiration were recorded from the snake. ECG records were obtained from the anesthetized and decapitated housefly. ECG records of the rabbit show slowing when the nose encountered irritating vapors. Records from a dog with atrial fibrillation exhibit rhythmic fibrillation frequency changes correlated with respiration. In addition, in a morphinized dog with atrial fibrillation, impulses crossed the AV node

only during inspiration. The ECGs of a cow and camel exhibit long P-R intervals and biphasic P waves. Finally the elephant ECG shows a clear U wave following the T wave.
Descriptors: reptiles, electrocardiograms, turtle, elephant, many species, collection of ECG's, physiological phenomena, dog, snake, rabbit, comparison study.

Gelli, D., M. Morgante, V. Ferrari, A. Mollo, D. Freggi, and S. Romagnoli (2004). **Hematologic, serum biochemical, and serum electrophoretic patterns in loggerhead sea turtles (*Caretta caretta*).** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 149-152. ISSN: 1529-9561.
NAL Call Number: SF996.A77
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, hematologic, serum biochemical, serum electrophoretic, patterns.

Govett, P.D., C.A. Harms, K.E. Linder, J.C. Marsh, and J. Wyneken (2004). **Effect of four different suture material on the surgical wound healing of loggerhead sea turtles, *Caretta caretta*.** *Journal of Herpetological Medicine and Surgery* 14(4): 6-12. ISSN: 1529-9651.
NAL Call Number: SF997.5.R4 B85
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, surgical wound healing, four different suture material, effect, surgical wound healing.

Greer, L.L., G.B. Daniel, V.I. Shearn Bochsler, and E.C. Ramsay (2005). **Evaluation of the use of technetium Tc 99m diethylenetriamine pentaacetic acid and technetium Tc 99m dimercaptosuccinic acid for scintigraphic imaging of the kidneys in green iguanas (*Iguana iguana*).** *American Journal of Veterinary Research* 66(1): 87-92. ISSN: 0002-9645.
NAL Call Number: 41.8 Am3A
Abstract: OBJECTIVE: To evaluate the use of scintigraphy involving technetium Tc 99m diethylenetriamine pentaacetic acid ((99m)Tc-DTPA) or technetium Tc 99m dimercaptosuccinic acid ((99m)Tc-DMSA) for the determination of kidney morphology and function in green iguanas (*Iguana iguana*). ANIMALS: 10 healthy iguanas weighing >1.6 kg. PROCEDURE: Renal scintigraphy was performed by use of (99m)Tc-DTPA in 6 of the iguanas and by use of (99m)Tc-DMSA in all 10 iguanas. After the injection of (99m)Tc-DMSA, scans were performed for each iguana at intervals during a 20-hour period. Renal biopsies were performed in all 10 iguanas after the final scintigraphic evaluation. RESULTS: In iguanas, the use of (99m)Tc-DTPA for renal scintigraphy was nondiagnostic because of serum protein binding and poor renal uptake of the isotope; mean +/- SD (99m)Tc-DTPA bound to serum proteins was 48.9 +/- 9.9%. Renal uptake of (99m)Tc-DMSA produced distinct visualization of both kidneys. Renal uptake and soft tissue clearance of (99m)Tc-DMSA increased over the 20-hour imaging period; mean +/- SD renal uptake of (99m)Tc-DMSA was 11.31 +/- 3.06% at 20 hours. In each of the 10 iguanas, ultrasonographic and histologic examinations of biopsy specimens from both kidneys revealed no abnormalities. CONCLUSIONS AND CLINICAL RELEVANCE: Results indicate that the kidneys of iguanas can be evaluated scintigraphically by use of (99m)Tc-DMSA; this technique may be potentially useful for the diagnosis of renal failure in iguanas.

Descriptors: green iguanas, *Iguana iguana*, anatomy, histology, kidney radionuclide imaging, radiopharmaceuticals diagnostic use, scintigraphic imaging, diagnosis.

Greer, L.L., J.D. Strandberg, and B.R.2. Whitaker (2003). ***Mycobacterium chelonae* osteoarthritis in a Kemp's ridley sea turtle (*Lepidochelys kempii*).** *Journal of Wildlife Diseases* 39(3): 736-741. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Abstract: A stranded Kemp's ridley sea turtle (*Lepidochelys kempii*) was rescued and treated at the National Aquarium in Baltimore (Maryland, USA) for inappetence and epidermal appendicular and plastral lesions. After 4 mo of care, the turtle developed a swollen left elbow joint. Within 1 mo of initial swelling, osteolytic lesions developed in the proximal radius and ulna. The elbow joint was surgically debrided, flushed, and cultured. The incision dehisced 10 days after surgery. *Mycobacterium chelonae* was cultured from the left elbow joint and from a skin nodule of the dorsum of the right front flipper. The turtle was euthanized due to apparent systemic infection with *M. chelonae*. *Mycobacterium chelonae* was isolated from cultures taken at necropsy of the lung, liver, spleen, kidney, and pericardium. Osteoarthritic infections with *M. chelonae* have not been reported in reptiles. Additionally, primary osteoarthritic diseases of synovial joints are uncommon in reptilian species. Due to the paucity of reports of mycobacterial diseases in sea turtles, the continued documentation of these cases will increase knowledge and understanding in caring for these endangered animals.
Descriptors: reptiles, Kemp's ridley sea turtle, *Mycobacterium chelonae*, osteoarthritis, elbow joint, necropsy, liver, spleen, kidney, pericardium, case study.

Grioni, A. (2005). **Prosthetic limb in a turtle.** *Exotic DVM* 7(4): 9-10. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, prosthetic limb, turtle, attachment, hindlimbs, surgery, veterinary procedure.

Guedes, R.M.C. and G.E. Lavalle (2004). **Hepatic cirrhosis in a red-food tortoise (*Geochelone carbonaria*). A case report**. *Arquivo Brasileiro De Medicina Veterinaria e Zootecnia* 56(1): 123-125. ISSN: 0102-0935.
Descriptors: reptiles, red footed tortoise, *Geochelone carbonaria*, hepatic cirrhosis, case report..
Language of Text: Portuguese.

Hanley, C.S. and S. Hernandez Divers (2003). **Practical gross pathology of reptiles.** *Seminars in Avian and Exotic Pet Medicine* 12(2): 71-80. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: reptiles, euthanasia, pathological techniques, necropsy, veterinary.

Hanson, B.A., P.A. Frank, J.W. Mertins, and J.L. Corn (2007). **Tick paralysis of a snake caused by *Amblyomma rotundatum* (Acari: Ixodidae).** *Journal of Medical Entomology* 44(1): 155-157. ISSN: 0022-2585.
NAL Call Number: 421 J828

Abstract: A lethargic southern black racer, *Coluber constrictor priapus* Dunn and Wood, wild-caught in the Florida Keys, Monroe County, FL, was found to be paralyzed by the bite of a female ixodid tick, *Amblyomma rotundatum* Koch (Acari: Ixodidae). Removal of the tick restored the snake to normalcy within 18 h. Other, earlier reported cases of tick toxicosis in reptiles are reviewed and clarified. Evidently, the present incident is the only reported case of tick paralysis in a poikilotherm found in a natural setting.
Descriptors: reptiles, snake, tick paralysis, paralyzed, female ixodid tick, *Amblyomma rotundatum* , wild caught.

Harkewicz, K.A. (2002). **Dermatologic problems of reptiles.** *Seminars in Avian and Exotic Pet Medicine* 11(3): 151-161. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: reptiles, skin, dermatological problems, parasites, diseases, disorders, veterinary, seminar.

Harms, C.A., M.G. Papich, M.A. Stamper, P.M. Ross, M.X. Rodriguez, and A.A. Hohn (2004). **Pharmacokinetics of oxytetracycline in loggerhead sea turtles (*Caretta caretta*) after single intravenous and intramuscular injections.** *Journal of Zoo and Wildlife Medicine* 35(4): 477-488. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Abstract: The pharmacokinetics of oxytetracycline in 2-yr-old loggerhead sea turtles (*Caretta caretta*) after single i.v. and i.m. injections were studied for biologic marking and therapeutic applications. Twenty juvenile turtles were divided into two treatment groups. Ten animals received 25 mg/kg of oxytetracycline i.v. and 10 received the same dosage i.m. Plasma oxytetracycline concentrations were analyzed by reverse-phase high-performance liquid chromatography. Data from the i.v. route best fit a three-compartment model, whereas noncompartmental analysis was used to compare data from both the i.v. and i.m routes. For the i.v. route, means for maximum plasma concentration, terminal phase half-life, systemic clearance, and apparent volume of distribution at steady state were 6.6 microg/ml, 66.1 hr, 290.7 ml/hr/kg, and 18.4 L, respectively. For the i.m. route, means for systemic availability, maximum plasma concentration, and elimination half-life were 91.8%, 1.6 microg/ml, and 61.9 hr, respectively. The remarkably high apparent volume of distribution may possibly be associated with a deep compartment of drug disposition such as bone deposition associated with the large skeletal mass of turtles and the fact that these were well-nourished, growing juveniles. Although maximum plasma concentration by i.m. administration was lower than for the i.v. route, the long elimination time indicates that an infrequent dosing interval may be effective for sensitive bacteria.
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, oxytetracycline, pharmacokinetics, intravenous, intramuscular, single injections.

Hejnar, P., J. Bardon, P. Sauer, and M. Kolar (2007). ***Stenotrophomonas maltophilia* as a part of normal oral bacterial flora in captive snakes and its susceptibility to antibiotics.** *Veterinary Microbiology* 121(3-4): 357-362. ISSN: 0378-1135.
NAL Call Number: SF601.V44

Abstract: Only little is known about normal oral bacterial flora in captive snakes containing *Stenotrophomonas maltophilia*. This microbe has been reported as a causative agent of numerous infections in reptiles. Therefore, the goal of the study was to detect its presence in the mouths of a significant number of healthy captive snakes and determining its susceptibility to antibiotics at 30 and 37 degrees C. The isolates were obtained in 1999-2005 from mouth swabs of 115 snakes of 12 genera and 22 species-most often *Elaphe guttata* (24 individuals; 20.9%). Susceptibility to 24 antibiotics was tested by the microdilution method. The microbe was demonstrated in 34 (29.6%) individuals. Overall, 47 strains of *S. maltophilia* were acquired. Evaluation using PFGE profiles and antibiograms resulted in confirmation of one strain of *S. maltophilia* in 23 (20.0%) individuals, two strains in nine (7.8%) and three in two (1.8%) snakes. All tested antibiotics were more effective at 37 degrees C, with the partial exception of cotrimoxazole and cefoperazone/sulbactam. At a temperature of 37 degrees C, the lowest frequency of resistance to levofloxacin (no resistant strains), cotrimoxazole and ofloxacin (97.9% of susceptible strains) was recorded. At 30 degrees C, the most active agents were cotrimoxazole (97.9% of susceptible strains), levofloxacin (91.5%) and ofloxacin (85.1%). In conclusion, *S. maltophilia* is present in the mouths of about one third of healthy captive snakes, showing good susceptibility to cotrimoxazole, some fluoroquinolones and aminoglycosides. The antibiotics (particularly aminoglycosides) are more effective at 37 degrees C.
Descriptors: reptiles, snakes, oral bacterial flora, captive snakes, *Stenotrophomonas maltophilia*, infection, susceptibility to antibiotics tested.

Helmick, K.E., M.G. Papich, K.A. Vliet, R.A. Bennett, and E.R. Jacobson (2004). **Pharmacokinetic disposition of a long-acting oxytetracycline formulation after single-dose intravenous and intramuscular administrations in the American alligator (*Alligator mississippiensis*).** *Journal of Zoo and Wildlife Medicine* 35(3): 341-346. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, American alligator, *Alligator mississippiensis*, oxytetracycline, long acting, single dose, intravenous, intramuscular, pharmacokinetic disposition.

Helmick, K.E., M.G. Papich, K.A. Vliet, R.A. Bennett, and E.R. Jacobson (2004). **Pharmacokinetics of enrofloxacin after single-dose oral and intravenous administration in the American alligator (*Alligator mississippiensis*).** *Journal of Zoo and Wildlife Medicine* 35(3): 333-340. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, American alligator, *Alligator mississippiensis*, enrofloxacin, single dose, intravenous, oral, pharmacokinetics.

Hernandez Divers, S.J. (2003). **Green iguana nephrology: a review of diagnostic techniques.** *Veterinary Clinics of North America, Exotic Animal Practice* 6(1): 233-250. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: There is still much to learn about renal physiology and pathophysiology in reptiles. In the case of the green iguana, initiating causes are often inferred from poor husbandry and nutrition, or extrapolated from histopathologic interpretations made late in the course

of the disease, or at postmortem. The link between parathyroid hormone and renal disease in humans has been well documented and, given the high prevalence of clinical (and subclinical) secondary nutritional hyperparathyroidism in iguanas, this certainly warrants further investigation in saurians [31,32,34,35]. Apart from hyperparathyroidism, chronic water deprivation also appears to be a common historic factor. As a foliovore originating from the high humidity rain forests of central and South America, water recovery is not considered to be an adaptive stress in *Iguana iguana*, and therefore, renal anatomy and physiology are considered to be non-specialized compared to more arid or aquatic reptiles [21]. These arboreal lizards do not voluntarily drink from open water but instead imbibe rain or dew droplets from foliage [2]. Maintaining such a species in low relative humidity with a water bowl from which to drink is likely to both increase insensible water losses and interfere with normal water intake. Appropriate therapeutic decisions (including euthanasia) can only be made following an accurate diagnosis. To date, our diagnoses are based largely upon the structural evaluations of renal histopathology, and renal biopsy remains our most useful tool. However, in the future it may become possible to evaluate renal function by quantifying glomerular filtration rate, proximal tubular secretion, or functional renal mass. Glomerular filtration rate may be estimated by measuring the rate of glomerular clearance of substances from the blood (e.g., iohexol). Phenolsulphonphthalein assays may offer an insight into proximal tubule secretion and renal blood flow.

Descriptors: reptiles, green iguana, *Iguana iguana*, anatomy, histology, kidney anatomy, histology, kidney diseases, blood cell count, diagnosis, radiography, ultrasonography, urinalysis.

Hernandez Divers, S.J. (2003). **Modern endoscopy equipment and advanced endoscopy techniques in birds and reptiles**. *Exotic DVM* 5(3): 61-63. ISSN: 1521-1363.

NAL Call Number: SF981.E96

Descriptors: reptiles, birds, modern endoscopy equipment, advanced endoscopy techniques , veterinary, conference information.

Notes: Meeting Information: International Conference on Exotics (ICE2003), Palm Beach, Florida, USA, 2003.

Hernandez Divers, S.J., J.E. Cooper, and S.W. Cooke (2004). **Diagnostic techniques and sample collection in reptiles.** *Compendium on Continuing Education for the Practicing Veterinarian* 26(6): 470-474,. ISSN: 0193-1903.

NAL Call Number: SF601.C66

Descriptors: reptiles, sampling, biopsy, endoscopy, veterinary equipment, diagnostic techniques, sample collection.

Hernandez Divers, S.J., H. Wilson, M. McBride, and K. Grant (2003). **Sedation/restraint of small lizards and snakes**. *Exotic DVM* 5(5): 9. ISSN: 1521-1363.

NAL Call Number: SF981.E96

Descriptors: reptiles, snakes, small lizards, sedation, restraint, anesthesia, anesthetics, analgesia, techniques.

Hernandez Divers, S.M. (2003). **Reptile critical care**. *Exotic DVM* 5(3): 81-87. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, critical care, anesthesia, anesthetics, analgesics, bone fractures, burns, catheterization, drug therapy, foreign bodies, intensive care, poisoning, prolapse, trauma, conference.
Notes: Meeting Information: International Conference on Exotics (ICE2003), Palm Beach, Florida, USA, 2003.

Hernandez Divers, S.M. and M.M. Garner (2003). **Neoplasia of reptiles with an emphasis on lizards.** *Veterinary Clinics of North America, Exotic Animal Practice* 6(1): 251-273. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Neoplasia is an important form of disease in saurians. According to previous reviews, the organs most commonly affected by neoplastic disease are the hematopoeitic system, the hepatic system, and the skin. However, our own review suggests that tumors of the musculoskeletal system are also prevalent. Neoplasia should be considered as a significant differential diagnosis when presented with a lizard that has nonspecific clinical signs. The previously described diagnostic techniques should be applied to obtain a rapid and accurate definitive diagnosis. As more cases of neoplastic disease in saurians are reported, a comprehensive study of the data, including detailed examination of environmental factors, may bring forth causative agents. According to Withrow, cancer is one of the leading killers of pet animals, and thus has become a real concern for dog and cat owners [67]. Given that most people will either know someone with cancer or experience cancer first hand, the general public is more educated than ever on neoplastic disorders. As veterinarians, it is important to become familiar with the neoplastic diseases in all species, and to be educated in tumor pathophysiology and treatment. The public expects veterinarians to be dependable sources of knowledge and compassion.
Descriptors: lizards, neoplasms, veterinarian awareness for all pet species, neoplasms diagnosis, neoplasms therapy.

Hernandez Divers, S.M., J. Schumacher, S. Stahl, and S.J. Hernandez Divers (2004). **Reptile clinical anesthesia: Advances in research.** *Exotic DVM* 6(3): 64-69. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, clinical anesthesia, analgesia, sedation, advances, research.

Hernandez Divers, S.J., S.M. Hernandez Divers, and H.G. Wilson (2005). **A review of reptile diagnostic coelioscopy.** *Journal of Herpetological Medicine and Surgery* 15(3): 16-31. ISSN: 1529-9651.
NAL Call Number: SF997.5.R4 B85
Descriptors: reptiles, diagnostic coelioscopy, review, Chelonia, Crocodilia, Squamata.

Hernandez Divers, S.J., S.J. Stahl, S.M. Hernandez Divers, M.R. Read, C.S. Hanley, F. Martinez, and T.L. Cooper (2004). **Coelomic endoscopy of the green iguana, *Iguana iguana*.** *Journal of Herpetological Medicine and Surgery* 14(1): 10-18. ISSN: 1529-9651.

NAL Call Number: SF997.5.R4 B85
Descriptors: reptiles, green iguana, *Iguana iguana* , coelomic endoscopy, veterinary procedure.

Hernandez Divers, S.J., S.J. Stahl, N.L. Stedman , S.M. Hernandez Divers, J. Schumacher, C.S. Hanley, H. Wilson, A.N. Vidyashankar, Y. Zhao, and W.K. Rumbeiha (2005). **Renal evaluation in the healthy green iguana (*Iguana iguana*): Assessment of plasma biochemistry, glomerular filtration rate, and endoscopic biopsy.** *Journal of Zoo and Wildlife Medicine* 36(2): 155-168. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, green iguana, *Iguana iguana*, renal evaluation, healthy iguana, plasma biochemistry, assessment, glomerular filtration rate, endoscopic biopsy.

Hidalgo Vila, J., C. Diaz Paniagua, C. de Frutos Escobar, C. Jimenez Martinez, and N. Perez Santigosa (2007). ***Salmonella* in free living terrestrial and aquatic turtles.** *Veterinary Microbiology* 119(2-4): 311-315. ISSN: 0378-1135.
NAL Call Number: SF601.V44
Abstract: Detection of *Salmonella* in pet turtles has been the focus of extensive research, but its incidence in free living turtles is not well known. The aim of this study was to evaluate the incidence of *Salmonella* in terrestrial and aquatic species of chelonians inhabiting a National Park in southwestern Spain. Individuals of the terrestrial tortoise *Testudo graeca* (n = 16) and the aquatic turtles *Emys orbicularis* (n = 26) and *Mauremys leprosa* (n = 50) were investigated. Maximum incidence of *Salmonella* was recorded in the terrestrial species (100%). In contrast, the incidence of infected animals was low in the aquatic species, 12% in *M. leprosa* and 15.4% in *E. orbicularis*. Five serotypes of *Salmonella* belonging to subspecies *Enterica* (I) and *Salamae* (II) were identified. All serotypes were found in the terrestrial species, and three in the aquatic ones, suggesting that wild terrestrial chelonians are important reservoirs of *Salmonella* in our study area. Cloacal transmission during mating is the most probable mode of transmission among individuals.
Descriptors: reptiles, turtles, aquatic, terrestrial, *Salmonella*, free living, pet turtles, cloacal transmission, incidence.

Hidalgo Vila, J., A. Martainez Silvestre, and C. Daiaz Paniagua (2006). **Benign ovarian teratoma in a red-eared slider turtle (*Trachemys scripta elegans*).** *Veterinary Record* 159(4): 122-123. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, red-eared slider turtle, *Trachemys scripta*, ovarian cancer, benign ovarian tumor, case study.

Hnizdo, J. and H. Velebny (2003). **Parcialni mandibulektomie v chirurgii malych zvirat a plazu. [Partial mandibulectomy in small animal and reptile surgery].** *Veterinarstvi* 53(11): 479-488. ISSN: 0506-8231.
Descriptors: reptiles, small animals, surgery, partial mandibulectomy.
Language of Text: Czech; Summary in English.

Hochleithner, C. and M. Hochleithner (2004). **Ultrasound in reptiles.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 41-44. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: reptiles, ultrasound, diagnosis, veterinary medicine, conference proceedings.

Hsieh, C.Y., T.C. Chang, Y.L. Shen, C.D. Chang, C. Tu, M.C. Tung, L.C. Chen, and S.S. Tsai (2006). **Pathological and PCR detection of mycobacteriosis in pond-cultured Chinese soft shell turtles, *Trionyx sinensis*.** *Aquaculture* 261(1): 10-16. ISSN: 0044-8486.
Abstract: Mycobacteriosis due to infection of *Mycobacterium marinum* is a common disease in pond-cultured Chinese soft shell turtles, especially in those surviving beyond their first year. The infected turtles independently showed either heterophilic or histiocytic granulomas in various organs such as the spleen, liver, lungs, intestine, kidneys, stomach and pancreas. The heterophilic granuloma contained many acid-fast unbranching bacilli intracellularly in macrophages and extracellularly in the necrotic center. The histiocytic granuloma had only a few bacteria, mainly in the cytoplasm of Langhan's giant cells. The organisms were rarely observed in the advanced lesions of both types. Based on PCR assays for partial hsp65 gene of Mycobacterium spp., all of our strains were identified as *M. marinum* which can be divided into two groups. The strains of the first group induced heterophilic granulomas and had very high nucleotide sequence identities (99.8%-100%) to the reference strains of *M. marinum* (AF456471) and *M. pseudoshottsii* (AY550226). Those strains of the second group caused histiocytic granulomas and also showed very high identities (99.8%-100%) to the reference strains of *M. marinum* ATCC 927 (AF456470) and *M. shottsii* (AY550225). However, when we compared the partial sequence of the hsp65 gene from group one and two strains the identities between the two groups range from 98.8% to 99.3%, therefore we can not assert that these two belong to the same species.
Descriptors: reptiles, soft shell turtles, *Trionyx sinensis*, *Mycobacterium marinum*, animal pathogenic bacteria, bacterial proteins, sequence analysis, disease detection, pathogen identification, histopathology, turtle culture.

Hyland, R.J. (2002). **Surgical removal of a fish hook from the oesophagus of a turtle.** *Australian Veterinary Journal* 80(1-2): 54-56. ISSN: 0005-0423.
NAL Call Number: 41.8 Au72
Descriptors: reptiles, turtles, esophagus, foreign bodies, fish hook, surgery removal, case studies.

Innis, C., M. Papich, and D. Young (2007). **Pharmacokinetics of metronidazole in the red-eared slider turtle (*Trachemys scripta elegans*) after single intracoelomic injection.** *Journal of Veterinary Pharmacology and Therapeutics* 30(2): 168-171. ISSN: 0140-7783.
Descriptors: reptiles, red eared slider turtle, *Trachemys scripta elegans*, metronidazole, pharmacokinetics, intracoelomic injection.

Innis, C.J., M. Garner, A. Johnson, and R. Ogust (2006). **Investigation of an upper alimentary tract disorder in a group of captive Arakan forest turtles (*Heosemys depressa*).** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 13: 83-86. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: reptiles, Arakan forest turtles, *Heosemys depressa*, upper alimentary tract disorder, investigation, captive.

Innis, C.J. and M.M. Garner (2006). **Spinal osteoarthropathy in green iguanas (*Iguana iguana*).** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 13: 40-42. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: reptiles, green iguanas, *Iguana iguana*, diseases, spinal osteoarthropathy, clinical, histopathological, observations.

Irizarry Rovira, A.R., A. Wolf, and J.A. Ramos Vara (2006). **Cutaneous melanophoroma in a green iguana (*Iguana iguana*).** *Veterinary Clinical Pathology* 35(1): 101-105. ISSN: 0275-6382.
NAL Call Number: SF601.A54
Abstract: An adult, male, green iguana (*Iguana iguana*) of unknown age was presented with a history of an enlarging, dark, skin mass in the right axillary region. The mass was excised because neoplasia was suspected. Impression smears of the cut surface of the mass were prepared for cytologic examination, and the mass was fixed for histologic examination. The impression smears contained numerous, discrete, pigmented, neoplastic cells consistent with melanin-producing neoplastic chromatophores. Histologic findings were consistent with a cutaneous melanophoroma. By transmission electron microscopy, the intracytoplasmic pigment granules corresponded to numerous melanosomes and lower numbers of premelanosomes. Tissue sections of the tumor were immunoreactive for Melan A antigen and were negative for S-100 antigen. The cytologic, histologic, electron microscopic, and immunohistochemical findings of the neoplasm were consistent with those of melanophoroma, an uncommon neoplasm of reptiles. The present report augments the limited body of knowledge on cytomorphologic and immunohistochemical characteristics of pigmented neoplasms in reptiles.
Descriptors: green iguana, *Iguana iguana*, skin neoplasms veterinary, skin neoplasms diagnosis, skin neoplasms pathology.

Jacobson, E.R. (2002). **Cytologic diagnosis of inclusion body disease of boid snakes.** *Proceedings of the North American Veterinary Conference* 16(16): 920. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, Boidae, cytoplasmic inclusions, animal diseases, cell biology, cytologic diagnosis, inclusion body, snakes.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida.

Jacobson, E.R. (2002). **Collection of blood from tortoises and sea turtles.** *Proceedings of the North American Veterinary Conference* 16(16): 918-919. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, tortoises, turtles, blood collection, sea turtles.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida.

Jacobson, E.R. (2002). **Infectious diseases of sea turtles.** *Proceedings of the North American Veterinary Conference* 16(16): 912-913. ISSN: 0002-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, turtles, infectious diseases, sea turtles.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Jacobson, E.R. (2003). ***Biology, Husbandry, and Medicine of the Green Iguana***, Malabar, USA: Krieger Publishing Company., 188 p. ISBN: 1575240653.
Descriptors: reptiles, green iguana, biology, husbandry, veterinary medicine, reproduction, nutrition, surgery, diagnostics.

Jacobson, E.R., G.R. Harman, L.K. Maxwell, and E.J. Laille (2003). **Plasma concentrations of praziquantel after oral administration of single and multiple doses in loggerhead sea turtles (*Caretta caretta*).** *American Journal of Veterinary Research* 64(3): 304-309. ISSN: 0002-9645.
NAL Call Number: 41.8 Am3A
Abstract: OBJECTIVE: To determine the pharmacokinetics of praziquantel following single and multiple oral dosing in loggerhead sea turtles. ANIMALS: 12 healthy juvenile loggerhead sea turtles. PROCEDURE: Praziquantel was administered orally as a single dose (25 and 50 mg/kg) to 2 groups of turtles; a multiple-dose study was then performed in which 6 turtles received 3 doses of praziquantel (25 mg/kg, PO) at 3-hour intervals. Blood samples were collected from all turtles before and at intervals after drug administration for assessment of plasma praziquantel concentrations. Pharmacokinetic analyses included maximum observed plasma concentration (Cmax), time to maximum concentration (Tmax), area under the plasma praziquantel concentration-time curve, and mean residence time (MRTt). RESULTS: Large interanimal variability in plasma praziquantel concentrations was observed for all dosages. One turtle that received 50 mg of praziquantel/kg developed skin lesions within 48 hours of administration. After administration of 25 or 50 mg of praziquantel/kg, mean plasma concentrations were below the limit of quantification after 24 hours. In the multiple-dose group of turtles, mean plasma concentration was 90 ng/mL at the last sampling time-point (48 hours after the first of 3 doses). In the single-dose study, mean Cmax and Tmax with dose were not significantly different between doses. After administration of multiple doses of praziquantel, only MRTt was significantly increased, compared with values after administration of a single 25-mg dose. CONCLUSIONS AND CLINICAL RELEVANCE: Oral administration of 25 mg of praziquantel/kg 3 times at 3-hour intervals may be appropriate for treatment of loggerhead sea turtles with spirorchidiasis.

Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, praziquantel, pharmacokinetics, plasma concentration, oral administration, single and multiple doses.

Jacobson, E.R.J. (2003). **Diagnostic approach to the sick reptile**. In: *Scientific Proceedings Veterinary Programme: British Small Animal Veterinary Association 46th Annual Congress,April 3, 2003-April 6, 2003, Birmingham, UK,* British Small Animal Veterinary Association: Quedgeley, UK, p. 385-387. ISBN: 0905214773.
Descriptors: reptiles, sick reptiles, diagnostic approach, veterinary medicine.

Jacobson, E., R. Gronwall, L. Maxwell, K. Merrit, and G. Harman (2005). **Plasma concentrations of enrofloxacin after single-dose oral administration in loggerhead sea turtles (*Caretta caretta*).** *Journal of Zoo and Wildlife Medicine* 36(4): 628-634. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, enrofloxacin, plasma concentrations, oral administration, single dose, blood levels.

Jaeger, G.H., M.A. Wosar, C.A. Harms, and G.A. Lewbart (2003). **Use of a supraplastron approach to the coelomic cavity for repair of an esophageal tear in a loggerhead sea turtle.** *Journal of the American Veterinary Medical Association* 223(3): 311, 353-355. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Abstract: A juvenile loggerhead sea turtle (*Caretta caretta*) was referred for removal of a fishhook lodged in the coelomic portion of the esophagus. Attempts at manual and endoscopic extraction were unsuccessful and resulted in a 6-cm tear in the coelomic portion of the esophagus. A supraplastron approach was made to the coelomic cavity, allowing access to and repair of the esophageal tear. The turtle recovered well and was able to be released to the wild. The surgical approach was associated with less trauma and shorter healing and rehabilitation times, compared with traditional plastron osteotomy.
Descriptors: reptiles, loggerhead sea turtle, *Caretta caretta*, esophageal tear, coelomic cavity, surgical repair, supraplaston approach, fishhook removal.

Jekl, V. and Z. Knotek (2006). **Endoscopic examination of snakes by access through an air sac.** *Veterinary Record* 158(12): 407. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Abstract: Sixteen boa constrictors (*Boa constrictor*), three royal pythons (*Python regius*) and 15 Burmese pythons (*Python molurus bivittatus*) were examined endoscopically by access through the air sac. The snakes were immobilised in a ventral position using a half-open anaesthetic system with assisted ventilation and a mixture of isoflurane and oxygen. The rigid endoscope was introduced percutaneously and the internal structure of the lungs and the air sac, and the shape, size and external surface of the liver were visible in the cranial direction. In the smaller snakes the bifurcation and caudal part of the trachea could be viewed, provided the endoscope was positioned in a retrograde orientation. The caudal orientation of the endoscope made it possible to view the gall bladder and the size, shape and surface of the spleen. In some cases, the pancreas and the surface of the stomach and colon could be monitored. Endoscopy through the air sac also made it possible to check the major veins in the

coelom. The snakes were monitored for at least 30 days after the intervention and no changes in their respiratory function or general health were observed.
Descriptors: snakes, Boidae, endoscopy veterinary, respiratory tract diseases veterinary, air sacs, anesthesia, endoscopy methods, liver pathology, lung pathology, respiratory tract diseases diagnosis, respiratory tract diseases pathology.

Johnson Delaney, C.A. (2005). **Techniques for ultrasound and guided biopsies in lizards.** *Exotic DVM* 7(3): 75-77. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, ultrasound, guided biopsies, lizards, techniques.

Johnson, J.H. (2004). **Husbandry and medicine of aquatic reptiles.** *Seminars in Avian and Exotic Pet Medicine* 13(4): 223-228. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: reptiles, aquatic, husbandry, captivity, medicine, treatment, parasites, diseases , disorders, feeding, water quality.

Kakizoe, Y., K. Sakaoka, F. Kakizoe, M. Yoshii, H. Nakamura, Y. Kanou, and I. Uchida (2007). **Successive changes of hematologic characteristics and plasma chemistry values of juvenile loggerhead turtles (*Caretta caretta*).** *Journal of Zoo and Wildlife Medicine* 38(1): 77-84. ISSN: 1042-7260.
Abstract: Hematologic characteristics and plasma chemistry values of juvenile loggerhead turtles (*Caretta caretta*) from the ages of 1 mo to 3 yr were obtained to establish baseline values. Five clinically normal loggerhead turtles were selected from the same clutch and raised in an indoor artificial nesting beach. Blood samples were successively collected and examined for various blood characteristics for a maximum total of 15 times. Hematologic characteristics, including packed cell volume, white blood cell counts, and white blood cell differentials; and plasma chemistry values, including total bilirubin, total protein, albumin, glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, gamma-glutamic transpeptidase, creatinine, blood urea nitrogen, uric acid, alkaline phosphatase, amylase, triglyceride, total cholesterol, ionized sodium, ionized potassium and ionized chlorine, were measured. These results were used to establish a hematology and blood chemistry baseline for captive juvenile loggerhead turtles and will aid in their medical management.
Descriptors: reptiles, loggerhead turtles, *Caretta caretta*, juvenile, hematologic characteristics, changes, plasma chemistry values, baseline values.

Kaufman, G.E., R.E. Seymour, B.B. Bonner, M.H. Court, and A.Z. Karas (2003). **Use of rocuronium for endotracheal intubation of North American Gulf Coast box turtles.** *Journal of the American Veterinary Medical Association* 222(8): 1111-1115. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Abstract: OBJECTIVE: To determine whether rocuronium, a reversible neuromuscular blocking agent, would provide safe, short-term immobilization to facilitate endotracheal intubation in turtles. DESIGN: Prospective study. ANIMALS: 30 healthy adult Gulf Coast box turtles. PROCEDURE: Turtles were given rocuronium, and responses were recorded

every 3 minutes. Times to onset of effects, intubation, and recovery were recorded and analyzed for associations with dose and patient characteristics to determine an optimal dose range. Neostigmine and glycopyrrolate were given to augment recovery from neuromuscular blockade. RESULTS: Rocuronium administered at a dose of 0.25 to 0.5 mg/kg (0.11 to 0.23 mg/lb), IM, permitted intubation; lower doses were not effective. Mean +/- SD time to loss of the palpebral reflex was 6.4 +/- 4.0 minutes, and mean time to intubation was 9.2 +/- 6.4 minutes. Mean time to return of the palpebral reflex was 44 +/- 13.2 minutes, and mean time to walking was 55 +/- 16.6 minutes. Time to onset of effects was not associated with dose, but recovery times were prolonged with higher doses of rocuronium. Cardiac arrhythmias were observed in 13 (43%) turtles. CONCLUSIONS AND CLINICAL RELEVANCE: Administration of rocuronium at a dose of 0.25 to 0.5 mg/kg is a safe and effective adjunct to general anesthesia in Gulf Coast box turtles. Because rocuronium does not provide any analgesic or sedative effects, the duration of neuromuscular blockade without anesthesia should be minimized to avoid undue distress.
Descriptors: reptiles, Gulf coast box turtle, endotracheal intubation, rocuronium, neuromuscular blocking agent, reversible, short term immobilization.

Kelly, T.R., W. Walton, B. Nadelstein, and G.A. Lewbart (2005). **Phacoemulsification of bilateral cataracts in a loggerhead sea turtle (*Caretta caretta*).** *Veterinary Record* 156(24): 774-777. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Abstract: An immature free-living loggerhead sea turtle (*Caretta caretta*) of unknown sex was found moribund off the coast of Wise Point, Virginia. It was suffering from cachexia and had bilateral hypermature cataracts which were treated by phacoemulsification under general anaesthesia. The surgery restored the turtle's vision and it was returned to the wild.
Descriptors: loggerhead sea turtle, *Caretta caretta*, cataracts, phacoemulsification, anesthesia, diagnosis, phacoemulsification methods, treatment outcome, veterinary procedure, case study.

Knotek, Z., K. Hauptman, Z. Knotkova, P. Hajkova, and F. Tichy (2002). **Renal disease haemogram and plasma biochemistry in green iguana.** *Acta Veterinaria Brno* 71(3): 333-340. ISSN: 0001-7213.
Online: http://vfu-www.vfu.cz/acta-vet/vol71/333-02.htm
NAL Call Number: SF604.B7
Descriptors: reptiles, green iguana, renal disease, haemogram, plasma biochemistry, veterinary.

Knotek, Z., Z. Knotkova, J. Doubek, S. Pejrilova, and K. Hauptman (2003). **Plasma biochemistry in female green iguanas (*Iguana iguana*) with calcium metabolism disorders**. *Acta Veterinaria Brno* 72(2): 183-189. ISSN: 0001-7213.
Online: http://vfu-www.vfu.cz/acta-vet/vol72/183-03.htm
NAL Call Number: SF604.B7
Descriptors: reptiles, female green iguanas, *Iguana iguana*, plasma biochemistry, calcium

metabolism disorders, diagnostic tool.
Language of Text: Czech.

Kohler, G. (2006). ***Diseases of Amphibians and Reptiles***, Malabar, USA: Krieger Publishing Company, 171 p. ISBN: 1575242559.
Descriptors: diseases, clinical aspects, diagnosis, euthanasia, examination, neoplasms, imaging techniques, surgery, treatment, amphibians, reptiles, blood tests, first aid, book.

Kuroki, T., Y. Une, and T. Endo (2003). ***Cryptosporidium* infections in reptiles**. *Japanese Journal of Zoo and Wildlife Medicine* 8(1): 27-34. ISSN: 1342-6133.
Descriptors: reptiles, diseases, *Cryptosporidium* infections, Veterinary, feces.
Language of Text: Japanese; Summary in English.

Lafortune, M., T. Gobel, E. Jacobson, D. Heard, D. Brown, R. Alleman, K. Vliet, K.E. Harr , and J. Hernandez (2005). **Respiratory bronchoscopy of subadult American alligators (*Alligator mississippiensis*) and tracheal wash evaluation.** *Journal of Zoo and Wildlife Medicine* 36(1): 12-20. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, alligators, *Alligator mississippiensis*, respiratory bronchoscopy, tracheal wash, procedures, evaluation.

Lafortune, M., J.F.X. Wellehan, D.J. Heard, E. Rooney DelPino, C.V. Fiorello, and E.R. Jacobson (2005). **Vacuum-assisted closure (Turtle VAC) in the management of traumatic shell defects in chelonians.** *Journal of Herpetological Medicine and Surgery* 15(4): 4-8. ISSN: 1529-9651.
NAL Call Number: SF997.5.R4 B85
Descriptors: reptiles, turtles, chelonians, traumatic shell defects, management, vacume assisted closure, wound management, shell injuries.

Lankester, F. and S.J. Hernandez Divers (2005). **Paraphimosis and amputation in a Nile crocodile (*Crocodylus niloticus*).** *Journal of Zoo and Wildlife Medicine* 36(4): 698-701. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, Nile crocodile, *Crocodylus niloticus*, paraphimosis, amputation, case report.

Lee AnHsing, Chen ChenYu, Lee YinnJie, Fei ChangYung, Liu ChenHsuan, and Chi ChauHwa (2003). **Case report: hepatozoonosis in Taiwan beauty snake**. *Taiwan Veterinary Journal* 29(2): 146-150. ISSN: 1682-6485.
NAL Call Number: SF604.C54
Descriptors: reptiles, Taiwan beauty snake, hepatazoonosis, case reports, diagnosis, haematology, treatment, necropsy.
Language of Text: Chinese; Summary in English.

Levine, B.S. (2003). **Surgical treatment of egg yolk peritonitis in a common green iguana**. *Exotic DVM* 5(2): 6-7. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, green iguana , *Iguana iguana*, egg yolk peritonitis, surgical treatment.

Levine, B.S. (2004). **Treatment of a malignant ovarian teratoma in a green iguana.** *Exotic DVM* 6(4): 12-14. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, green iguana , *Iguana iguana*, ovarian teratoma, malignant , treatment.

Levine, B.S. (2004). **Surgical treatment of abscessed hemipenes in a collared lizard.** *Exotic DVM* 6(4): 7-9. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, collared lizard, *Crotaphytus collaris*, abscessed hemipenes, surgical treatment, case study.

Lewis, W.G.V. (2003). **Dystocia in a tortoise**. *Exotic DVM* 5(1): 14. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, dystocia, tortoise, case reports, clinical aspects, diagnosis, surgical operations.

Lloyd, C., R. Manvell, S. Drury, and A.W. Sainsbury (2005). **Seroprevalence and significance of paramyxovirus titres in a zoological collection of lizards.** *Veterinary Record* 156(18): 578-580. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: lizards, paramyxovirus, titres, antibodies, seroprevalence, zoo, immunosorbent assay, London, respirovirus infections, epidemiology, significance.

Lock, B.A. and L. McCaskill (2004). **Operant conditioning for the husbandry and medical management of a large group of adult Nile crocodiles at Disney's Animal Kingdom.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 59-61. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: reptiles, Nile crocodiles, *Crocodylus niloticus*, operant conditioning, husbandry, medical management, captive zoo animals.

Longley, L. (2004). **Practitioner's guide to reptile anaesthesia**. *Veterinary Times* 34(31): 22-23. ISSN: 1352-9374.
Descriptors: reptiles, anesthesia, analgesia, dosage and administration.

Longley, L. (2004). **Reptile analgesia**. *Veterinary Times* 34(25): 30. ISSN: 1352-9374.
Descriptors: reptiles, anesthetics, analgesics, antagonists, ketamine, non steroidal anti-inflammatory agents, opioids, pain, pharmacodynamics.

Lopez Olvera, J.R., J. Montane, I. Marco, A. Martinez Silvestre, J. Soler, and S. Lavin (2003). **Effect of venipuncture site on hematologic and serum biochemical parameters in marginated tortoise (*Testudo marginata*).** *Journal of Wildlife Diseases* 39(4): 830-836. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: reptiles, tortoise, *Testudo marginata*, venipuncture site, effect, hematologic parameters, serum biochemical parameters, marginated tortoise, blood samples.

Loukopoulos, P., A. Komnenou, E. Papadopoulos, and V. Psychas (2007). **Lethal *Ozolaimus megatyphlon* infection in a green iguana (*Iguana iguana rhinolopa*).** *Journal of Zoo and Wildlife Medicine* 38(1): 131-134. ISSN: 1042-7260.
Abstract: An imported 2.5-yr-old female green iguana (*Iguana iguana rhinolopa*) kept in Greece was presented with a history of anorexia and allotriophagy of 1 mo duration. Upon clinical examination, it was cachectic and had severe abdominal distension and fibrous osteodystrophy. Despite treatment, it died a month later. On necropsy, massive accumulations of threadlike nematode parasites were observed in the large intestine, identified as *Ozolaimus megatyphlon,* a member of the Oxyuridae family of Pharyngodonidae, a usually nonpathogenic intestinal parasite of iguanas. To the authors' knowledge, its presence has not been reported previously in Europe, although one pathogenic infection has been reported previously in Japan. The animal was presumably infected before importation. Although death was attributed to the heavy parasitic overload, the poor diet and terrarium hygiene, and absence of an anthelminthic regime further contributed to the deterioration of the animal's condition. Recognition of this condition, which may be recently introduced or underdiagnosed, may help improve medical and trade standards concerning this species in practice.
Descriptors: reptiles, green iguana, infection, nematode, parasites, abdominal distension, fibrous osteodystrophy.

Luechtefeld, L. (2004). **West Nile transmitted from alligator to human**. *Veterinary Practice News* 16(1): 14. ISSN: 1528-6398.
Descriptors: reptiles, alligator, West Nile virus, transmitted to human, virus shedding, feces.

MacNeill, A.L., E.W. Uhl, H. Kolenda Roberts, and E. Jacobson (2002). **Mortality in a wood turtle (*Clemmys insculpta*) collection.** *Veterinary Clinical Pathology* 31(3): 133-136. ISSN: 0275-6382.
NAL Call Number: SF601.A54
Descriptors: reptiles, turtles, *Clemmys insculpta*, mortality, liver, symptoms, disease outbreaks, developmental stages, vacuoles, case studies, *Entamoeba invadens*, diagnosis, clinical aspects, case study.

Macri, F., F. Spadola, M. Musico, A. Brunetti, G. Costa, and G. Cucinotta (2004). **L'esame radiologico nei rettili. Nota II - impiego del mezzo di contrasto. [Radiological examination of reptiles. Note II - Use of the contrast method].** *Obiettivi e Documenti Veterinari* 25(4): 35-40. ISSN: 0392-1913.
Descriptors: reptiles, radiological examination, contrast method, diagnosis, turtles, tor-

toises, iguanas, snakes.
Language of Text: Italian; Summary in English.

Mader, D. (2004). **Clinical approach to infectious stomatitis in reptiles**. *Proceedings of the North American Veterinary Conference* 18: 1338-1339. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, infectious stomatitis, clinical approach, veterinary medicine.
Notes: In the volume: Small Animal and Exotics. Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Mader, D.R. (2002). **Ventral midline approach for the lizard coeliotomy.** *Proceedings of the North American Veterinary Conference* 16(16): 932. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, lizards , surgery, methodology, coeliotomy, ventral midline, approach, meeting.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida.

Mader, D.R. (2002). **Tail problems in the green iguana.** *Proceedings of the North American Veterinary Conference* 16(16): 925-926. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, Iguana, tail, animal injuries, medical treatment, problems, meeting.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida.

Mader, D.R. (2002). **Reproductive surgery in the green iguana.** *Proceedings of the North American Veterinary Conference* 16(16): 923-924. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, Iguana, ovariectomy, ovulation, females, surgery, reproductive, meeting.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida.

Mader, D.R. and M.M. Garner (2002). **Metabolic bone diseases in the green iguana.** *Proceedings of the North American Veterinary Conference* 16(16): 921-922. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, Iguana, metabolic diseases, bone diseases, veterinary care, diagnosis, meeting.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida.

Mader, D.R. (Editor) (2006). ***Reptile Medicine and Surgery*** , 2nd edition, Saunders Elsevier: St. Louis, MO, 1242 p. ISBN: 072169327X.
NAL Call Number: SF997.5.R4 R46 2006
Descriptors: captive reptiles, veterinary medicine, surgery, diseases, treatment.

Mallo, K.M., C.A. Harms, G.A. Lewbart, and M.G. Papich (2002). **Pharmacokinetics of fluconazole in loggerhead sea turtles (*Caretta caretta*) after single intravenous and subcutaneous injections, and multiple subcutaneous injections.** *Journal of Zoo and Wildlife Medicine* 33(1): 29-35. ISSN: 1042-7260.

NAL Call Number: SF601.J6

Abstract: Superficial and systemic mycotic infections are common among clinically ill sea turtles, which places growing importance on the establishment of pharmacokinetic-based dosage regimens for antifungal drugs. The pharmacokinetic properties of the antifungal drug fluconazole, after intravenous (i.v.) and subcutaneous (s.c.) injections, were studied in juvenile loggerhead sea turtles (*Caretta caretta*) housed at 23.0-26.5 degrees C. Fluconazole pharmacokinetic properties were further assessed in a multiple-dose s.c. regimen derived from the pharmacokinetic parameters determined in the single-dose study. Pharmacokinetic parameters were calculated, using a two-compartment model, from plasma concentration-time data obtained after single i.v. and s.c. administrations of fluconazole at a dosage of 2.5 mg/ kg body weight in six juvenile sea turtles. Blood samples were collected at intervals through 120 hr after each dose, and the concentration of fluconazole in plasma was measured by reverse-phase high-performance liquid chromatography. The i.v. and s.c. elimination half-lives were 139.5 +/- 36.0 and 132.6 +/- 48.7 hr (mean +/- SD), respectively. Systemic clearance of fluconazole was 8.2 +/- 4.3 ml/kg x hr, and the apparent volume of distribution at steady state was 1.38 +/- 0.29 L/kg. A multiple-dose regimen was derived, which consisted of a loading dose of 21 mg/kg body weight and subsequent doses of 10 mg/kg administered through s.c. injection every 120 hr (5 days). This regimen was administered to four juvenile sea turtles for 10 days, and blood samples were taken to determine peak and trough plasma concentrations of fluconazole. The mean concentrations for the two peak concentrations were 16.9 +/- 1.1 and 19.1 +/- 2.8 microg/ml 4 hr after dosing, and the mean concentrations for the three trough concentrations were 7.2 +/- 2.2, 10.4 +/- 2.7, and 10.7 +/- 2.9 microg/ml 120 hr after dosing. The terminal half-life after the last dose was calculated at 143 hr. Throughout the multiple dosing, fluconazole concentrations remained above approximately 8 microg/ml, a concentration targeted when treating mycotic infections in humans. The results of this study suggest that fluconazole can be effectively administered to sea turtles at a dosage of 10 mg/kg every 5 days after a loading dose of 21 mg/kg.

Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, fluconazole, pharmacokinetics, injections, intravenous, subcutaneous, antifungal drugs.

Manire, C.A., H.L. Rhinehart, G.J. Pennick, D.A. Sutton, R.P. Hunter, and M.G. Rinaldi (2003). **Steady-state plasma concentrations of itraconazole after oral administration in Kemp's ridley sea turtles, *Lepidochelys kempi*.** *Journal of Zoo and Wildlife Medicine* 34(2): 171-178. ISSN: 1042-7260.

NAL Call Number: SF601.J6

Abstract: Pharmacokinetic studies of antifungal agents in reptiles are uncommon. Itraconazole, which has been used prophylactically in juvenile sea turtles suffering from hypothermia (cold stunning) on a regular basis, was evaluated for steady-state plasma concentrations. Five Kemp's ridley sea turtles (*Lepidochelys kempi*) receiving itraconazole at several dosages in a rehabilitation program had blood collected within 24 hr to estimate dosing frequency.

Subsequently, serial blood samples of Kemp's ridley sea turtles that were given itraconazole at several dosages for 30 days to treat cold stunning were collected at various intervals to evaluate itraconazole plasma concentrations. Tissue samples were collected from one Kemp's ridley that died during rehabilitation. Plasma concentrations of itraconazole (and of hydroxyitraconazole [OH-ITRA], one of its major bioactive metabolites) were determined using a modified, validated reverse-phase high-performance liquid chromatography technique. Itraconazole concentrations in tissues were determined by bioassay to be far greater than the plasma concentrations measured in any of the turtles. At a 15-mg/kg dosage, the half-life (t1/2) was 75 hr for itraconazole and 55 hr for OH-ITRA. All dosages produced adequate concentrations in some turtles, but consistent therapeutic concentrations were produced only at 15 mg/kg q72hr and 5 mg/kg s.i.d., with the latter producing the highest plasma concentrations.

Descriptors: reptiles, Kemp's ridley sea turtles, *Lepidochelys kempi*, itraconazole, antifugal agent, plasma concentration, oral administration, hypothermia.

Manire, C.A., R.P. Hunter, D.E. Koch, L. Byrd, and H.L. Rhinehart (2005). **Pharmacokinetics of ticarcillin in the loggerhead sea turtle (*Caretta caretta*) after single intravenous and intramuscular injections.** *Journal of Zoo and Wildlife Medicine* 36(1): 44-53. ISSN: 1042-7260.

NAL Call Number: SF601.J6

Descriptors: reptiles, loggerhead sea turtle, *Caretta caretta*, pharmacokinetics, ticarcillin, single intravenous, intramuscular injections.

Martinez Silvestre, A., J.A. Mateo, and J. Pether (2003). **Electrocardiographic parameters in the Gomeran giant lizard, *Gallotia bravoana*.** *Journal of Herpetological Medicine and Surgery* 13(3): 22-25. ISSN: 1529-9651.

NAL Call Number: SF997.5.R4 B85

Descriptors: reptiles, Gomeran giant lizard, *Gallotia bravoana*, heart rate, electrocardiographic parameters.

Martinez Silvestre, A., M.A. Rodriguez Dominguez, J.A. Mateo, J. Pastor, I. Marco, S. Lavin, and R. Cuenca (2004). **Comparative haematology and blood chemistry of endangered lizards (*Gallotia* species) in the Canary Islands.** *Veterinary Record* 155(9): 266-269. ISSN: 0042-4900.

NAL Call Number: 41.8 V641

Abstract: Blood samples were taken from the ventral coccygeal vein of 15 El Hierro giant lizards (*Gallotia simonyi*) (seven females and eight males), six La Gomera giant lizards (*Gallotia bravoana*) (four males and two females) and four Tenerife giant lizards (*Gallotia intermedia*) (two males and two females), and 31 blood parameters were measured. Among the haematological parameters there were significant differences between the three species in heterophils, azurophils and lymphocytes, but no significant differences in red blood cell count, white blood cell count, haemoglobin, packed-cell volume, monocytes, eosinophils and basophils. In terms of blood chemistry there were significant differences between the three species in cholesterol, triglycerides, glucose, sodium, chloride, urea, uric acid, total pro-

teins, prealbumin, albumin and gamma globulins, but no significant differences in calcium, potassium, aspartate aminotransferase, alanine aminotransferase, creatine kinase, bile acids, alpha-1 and alpha-2 globulins and beta globulins.
Descriptors: reptiles, endangered lizards, La Gomera giant lizards, *Gallotia* species, blood chemistry, comparative haematology, Hierro giant lizards, Tenerife giant lizards, blood parameters, Canary Islands.

Martinez Silvestre, A., J.L. Silva, and L. Silveira (2002). **Hematologia y bioquimica sanguinea del lagarto gigante de El Hierro (*Gallotia simonyi*) en cautividad. [Hematology and blood chemistry of captive El Hierro giant lizard (*Gallotia simonyi*).]**. *Revista Espanola De Herpetologia* 16: 5-10. ISSN: 0213-6686.
Descriptors: reptiles, giant lizard, *Gallotia simonyi*, blood chemistry, hematology, captive.
Language of Text: Spanish; Summary in English and Spanish.

Maticic, D., M. Stejskal, D. Vnuk, D. Stanin, T. Babic, and M. Pecin (2007). **Internal fixation of a femoral fracture in a green iguana developing metabolic bone disease - a case report**. *Veterinarski Arhiv* 77(1): 81-86. ISSN: 0372-5480.
Descriptors: reptiles, green iguana, femoral fracture, internal fixation, metabolic bone disease, open reduction, intramedullary pin fixation, case report.

Mauthe von Degerfeld, M. (2004). **Personal experiences in the use of association tiletamine/zolazepam for anaesthesia of the green iguana (*Iguana iguana*).** *Veterinary Research Communications* 28(1): 351-353 (Suppl). ISSN: 0165-7380.
Descriptors: reptiles, green iguana, *Iguana iguana*, sedation, anesthesia, analgesia, tiletamine, zolazepam.

Maxwell, L.K. and E.R. Jacobson (2004). **Allometric scaling of kidney function in green iguanas *Iguana iguana***. *Comparative Biochemistry and Physiology Part A, Molecular and Integrative Physiology* 138(3): 383-390. ISSN: 1095-6433.
Descriptors: reptiles, green iguanas, *Iguana iguana*, kidney function, allometric scaling, renal scintigraphy, diagnostic tool, glomerular filtration rate.

McArthur, S., R. Wilkinson and J. Meyer (Editors) (2004). ***Medicine and Surgery of Tortoises and Turtles.***, Blackwell Publishing: Oxford, 579 p. ISBN: 1405108894.
NAL Call Number: SF997.5.T87 M37 2004
Descriptors: reptiles, tortoises, turtles, captive care, surgery, diseases.

McBride, M. and S.J. Hernandez Divers (2004). **Nursing care of lizards.** *Veterinary Clinics of North America, Exotic Animal Practice* 7(2): 375-396. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: This article should introduce to the veterinary staff some of the basic information that is required to provide high-quality medicine to lizards. This article begins with a brief introduction to lizards and their husbandry, including caging, lighting, humidity, and diet.Making appointments for lizards, taking a history, manual restraint,venipuncture, fecal sampling, catheterization, medications,administering fluids, giving injections, radiology, and

anesthesia are all detailed for veterinary technicians and veterinary animal care staff. Each section details differences between lizards and typical mammalian patients while trying to emphasize the common approach to both groups of animals.
Descriptors: reptiles, animal husbandry, lizards, animal technicians, veterinary medicine, caging, humidity, diet, medications.

Mehler, S.J. and R.A. Bennett (2003). **Oral, dental, and beak disorders of reptiles.** *Veterinary Clinics of North America, Exotic Animal Practice* 6(3): 477-503. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Each species of reptile has evolved unique characteristics that are associated with their oral cavity, dentition, tongue, glands, and methods of mastication. These developments have provided each with an opportunity to interact with their surroundings. In captivity, the developmental relationship is often severed by the introduction of artificial surroundings and inappropriate husbandry. These changes predispose the animals to many stresses and disorders. Disorders of the oral cavity are often a representation of what is occurring systemically. Bacterial, viral, fungal, parasitic, neoplastic, and nutritional causes of disorders of the oral cavity in reptilian species are probably underestimated and likely cause a higher incidence of morbidity and mortality than has been reported. The misinformation that clients receive regarding husbandry may directly correlate with the frequency of oral diseases seen in a clinical setting. Prevention of disease of the oral cavity is primarily through providing appropriate environmental conditions and diet.
Descriptors: reptiles, beak anatomy, mouth anatomy, histology, mouth diseases, reptiles anatomy, histology, tooth anatomy, tooth diseases, feeding behavior, mouth diseases.

Mehler, S.J., D.S. Rosenstein, and J.S. Patterson (2002). **Imaging diagnosis--follicular torsion in a green iguana (*Iguana iguana*) with involvment of the left adrenal gland.** *Veterinary Radiology and Ultrasound* 43(4): 343-345. ISSN: 1058-8183.
NAL Call Number: SF757.8.A4
Descriptors: reptiles, green iguana, *Iguana iguana*, radiography, ultrasonography, ovarian follicles, adrenal glands, surgery, histopathology, females, diagnosis, torsion, adrenal gland.

Merchant, M. and A. Britton (2006). **Characterization of serum complement activity of saltwater (*Crocodylus porosus*) and freshwater (*Crocodylus johnstoni*) crocodiles.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 143(4): 488-493. ISSN: 1095-6433.
Abstract: We employed a spectroscopic assay, based on the hemolysis of sheep red blood cells (SRBCs), to assess the innate immune function of saltwater and freshwater crocodiles in vitro. Incubation of serum from freshwater and saltwater crocodiles with SRBCs resulted in concentration-dependent increases in SRBC hemolysis. The hemolytic activity occurred rapidly, with detectable activity within 2 min and maximum activity at 20 min. These activities, in both crocodilian species, were heat sensitive, unaffected by 20 mM methylamine, and completely inhibited by low concentrations of EDTA, suggesting that the alternative serum complement cascade is responsible for the observed effects. The hemolytic activities of the sera were inhibited by other chelators of divalent metal ions, such as phosphate and citrate.

The inhibition of SRBC hemolysis by EDTA could be completely restored by the addition of 10 mM Ca2+ or Mg2+, but not Ba2+, Cu2+ or Fe2+, indicating specificity for these metal ions. The serum complement activities of both crocodilians were temperature-dependent, with peak activities occurring at 25-30 degrees C and reduced activities below 25 degrees C and above 35 degrees C.

Descriptors: reptiles, saltwater (*Crocodylus porosus*) and freshwater (*Crocodylus johnstoni*) crocodiles, crocodiles blood, complement system proteins metabolism, barium pharmacology, calcium pharmacology, copper pharmacology, edetic acid pharmacology, erythrocytes metabolism, fresh water, hemolysis drug effects, iron pharmacology, kinetics, magnesium pharmacology, temperature.

Mihalca, A.D., P. Fictum, M. Skoric, M. Sloboda, S. Karvemo, I. Ghira, M. Carlsson, and D. Modry (2007). **Severe granulomatous lesions in several Organs from Eustrongylides larvae in a free-ranging dice snake, *Natrix tessellata*.** *Veterinary Pathology* 44(1): 103-105. ISSN: 0300-9858.

Online: http://www.vetpathology.org/cgi/content/abstract/44/1/103

NAL Call Number: 41.8 P27

Abstract: During an extensive study regarding the epidemiology of larval Eustrongylides infestation in a free-ranging endangered population of dice snakes () from Histria, Romania, an adult female was euthanized to evaluate pathologic changes. Parasites appeared as nodules at various locations: in subcutaneous connective tissues, on the serosae of the intestines and liver. Histologic sections revealed nematode larvae surrounded by a capsule, forming a parasitic granuloma with 3 layers: macrophage layer, lymphocyte layer, and fibrous capsule. Differences between newly formed and mature granulomas consisted mainly in the eosinophilic infiltration. Other types of parasitic granulomas of reptiles are discussed in comparison with our findings.

Descriptors: reptiles, Colubridae, snakes, *Natrix tessellata*, Eustrongylides, nematode infections, nematode larvae, lesions (animal), granuloma, histopathology, parasitic granuloma.

Miller, D.L., J. Wyneken, S. Rajeev, D.R. Mader, J. Weege, and C.A. Baldwin (2006). **Loss in a group of leatherback sea turtle (*Dermochelys coriacea*) post-hatchlings: pathologic findings and speculations on pathogenesis.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 13: 16-18. ISSN: 1529-9651.

NAL Call Number: SF996.A77

Descriptors: reptiles, sea turtle, *Dermochelys coriacea*, mortality losses, post hatchlings, pathologic findings, pathogenesis, speculations.

Mitchell, M.A. (2004). **Snake care and husbandry.** *Veterinary Clinics of North America, Exotic Animal Practice* 7(2): 421-446. ISSN: 1094-9194.

NAL Call Number: SF997.5.E95 E97

Abstract: The snake has long been a contradictory species; you either love them or hate them. In the United States, these reptiles are popular pets.There is also a significant amount of energy placed into developing captive breeding programs to produce different color morphs for many species. In some cases, such as the ball pythons (Pythonregius), these

color morphs can sell for 20,000 dollars to 30,000 dollars each. In comparison to domestic mammals, snakes are long-lived. It is not uncommon for corn snakes (*Elaphe guttata guttata*) to live for 15 to 25 years and for ball pythons to live 35 to 45 years. Because of the longevity and value of these animals, more snakes are being presented to the veterinarian to manage medical and surgical problems,as well as for routine medical care. Veterinary personnel working with snakes should familiarize themselves with the specific husbandry and medical requirements of these animals so that they can make informed decisions regarding their management.
Descriptors: animal husbandry, captive snakes, veterinary medicine, care.

Mitchell, M.A. (2002). **Diagnosis and management of reptile orthopedic injuries.** *Veterinary Clinics of North America, Exotic Animal Practice* 5(1): 97-114. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: As veterinarians expand their understanding of the specific husbandry requirements for captive reptiles, nutritionally associated orthopedic injuries should decrease. Orthopedic injuries in wild reptiles, however, will continue to increase as new infrastructure encroaches on the habitats of these animals. Research should be pursued that focuses on improving our understanding of pain management in reptiles, on developing techniques to expedite bone healing, and on creating new orthopedic techniques that provide rigid stabilization without the use of temperature-sensitive materials.
Descriptors: reptiles, fixation, fractures, bone, injuries, fractures, diagnosis, orthopedics, therapy, pain management, bone healing.

Mitchell, M.A. and O. Diaz Figueroa (2005). **Clinical Reptile Gastroenterology.** *Veterinary Clinics of North America, Exotic Animal Practice* 8(2): 277-298. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Descriptors: reptile, gastrointestinal diseases, anatomy, histology, reptiles physiology, adaptation, diagnosis, foreign bodies diagnosis, therapy, prevention, control.

Mitchell, M.A. and O. Diaz Figueroa (2004). **Wound management in reptiles.** *Veterinary Clinics of North America, Exotic Animal Practice* 7(1): 123-140. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Descriptors: reptiles, wound management, care, treatment, surgery, veterinary care.

Mosley, C.A.E., D. Dyson, and D.A. Smith (2003). **The cardiac anesthetic index of isoflurane in green iguanas**. *Journal of the American Veterinary Medical Association* 222(11): 1565-1568. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Descriptors: reptiles, green iguanas, isoflurane, cardiac anesthetic index, butorphanol , induction of anesthesia, cardiovascular arrest.

Mosley, C.A.E., D. Dyson, and D.A. Smith (2003). **Minimum alveolar concentration of isoflurane in green iguanas and the effect of butorphanol on minimum alveolar concentration**. *Journal of the American Veterinary Medical Association* 222(11): 1559-1564. ISSN: 0003-

1488.
NAL Call Number: 41.8 Am3
Descriptors: reptiles, green iguanas, isoflurane, minimum alveolar concentration, butorphanol, effect on mimimum alveolar concentration.

Murray, M.J. (2002). **Endoscopy in reptiles.** *Proceedings of the North American Veterinary Conference* 16(16): 937-939. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, endoscopy, veterinary, diagnosis, technique, meeting.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Musico, M., F. Spadola, F. Macri, E. Navarra, G. Costa, and G. Cucinotta (2004). **L'esame radiologico nei rettili. [The radiological examination of reptiles].** *Obiettivi e Documenti Veterinari* 25(3): 29-35. ISSN: 0392-1913.
Descriptors: reptiles, radiological examination, veterinary , diagnosis.
Language of Text: Italian; Summary in English.

Nevarez, J.G., G.R. Pettifer, and M.A. Mitchell (2002). **Anesthesia case of the month. A suitable choice for anesthetic management of a green iguana for an orchidectomy.** *Journal of the American Veterinary Medical Association* 220(7): 982-985. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Descriptors: reptiles, green iguana, anesthesia, orchidectomy, anesthetic management, case of the month.

Oprescu, I. (2003). **Bolile parazitare ale reptilelor si terapia lor. [The parasitic diseases of reptiles and their treatment].** *Revista Romana De Medicina Veterinara* 13(2): 82-94. ISSN: 1220-3173.
Descriptors: reptiles, parasitic diseases, treatment, veterinary.
Language of Text: Romanian; Summary in English.

Oros, J., P. Calabuig, and S. Deniz (2004). **Digestive pathology of sea turtles stranded in the Canary Islands between 1993 and 2001.** *Veterinary Record* 155(6): 169-174. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, sea turtles, lesions (animal), digestive system, diseases, pathology, stranded, Canary Islands.

Oros, J., C. Delgado, L. Fernandez, and H.E. Jensen (2004). **Pulmonary hyalohyphomycosis caused by *Fusarium* spp. in a Kemp's ridley sea turtle (*Lepidochelys kempi*): An immunohistochemical study**. *New Zealand Veterinary Journal* 52(3): 150-152. ISSN: 0048-0169.
NAL Call Number: 41.8 N483
Descriptors: reptiles, Kemp's ridley sea turtle, *Lepidochelys kempi*, pulmonary hyalohypomycosis, *Fusarium* specis, immunohistochemical study.

Otokunefor, T.V., B.I. Kindzeka, I.O. Ibiteye, G.U. Osuji, F.O. Obi, and A.W.K. Jack (2003). **Salmonella in gut and droppings of three pest lizards in Nigeria.** *World Journal of Microbiology and Biotechnology* 19(5): 545-548. ISSN: 0959-3993.
NAL Call Number: QR1.M562
Descriptors: reptiles, *Gekkonidae* sp., *Lacertilia*, lizards, disease vectors, household pests, feces, intestinal microorganisms, food pathogens, animal pathogens, *Salmonella*, *Agama agama*, *Ameiva ameiva.*, Nigeria.

Pare, J.A. (2004). **The treatment of mycoses in reptiles: a review of antifungal drugs.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 72-76. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: reptiles, diseases, mycosis, treatment, review, antifungal drugs.

Pasmans, F., P.d. Herdt, J. Dewulf, and F. Haesebrouck (2002). **Pathogenesis of infections with *Salmonella enterica* subsp. *enterica serovar Muenchen* in the turtle *Trachemys scripta scripta*.** *Veterinary Microbiology* 87(4): 315-325. ISSN: 0378-1135.
NAL Call Number: SF601.V44
Abstract: The pathogenesis of *Salmonella enterica* subsp. *enterica serovar Muenchen* infections in the aquatic turtle *Trachemys scripta scripta* was studied. After oral infection with 5 x 10(5) cfu of serovar Muenchen of 10-14-month-old turtles, kept at 26 degrees C, the intestine and especially the ileum, caecum and colon was colonized. Invasion of the intestinal wall, causing histopathological lesions, and colonization of internal organs were not observed. Serovar Muenchen was only isolated from turtles for 8 days after exposure. Keeping the turtles at 37 degrees C caused colonization of liver and spleen in two of six orally infected turtles and augmented the numbers of bacteria in the intestinal tract. In contrast to oral infections, intraperitoneal infections of turtles with serovar Muenchen enabled the bacterium to persist inside the host for at least 5 weeks. Clearance of serovar Muenchen from the liver and blood was more pronounced at 26 degrees C than at 37 degrees C. ELISA antibodies were demonstrated in intraperitoneally but not in orally infected turtles kept at 26 degrees C. In conclusion, the lack of persistence and invasiveness of serovar Muenchen in *T. s. scripta* after oral exposure might be due to the turtle's relatively low body temperature and/or the absence of well-organized gut-associated lymphoid tissue.
Descriptors: reptiles, Cheloniidae, *Salmonella* , genetic variation, pathogenesis, disease course, intestines, ileum, cecum, colon, infection, histopathology, shedding, persistence.

Pejrilova, S., Z. Knotkova, Z. Knotek, and V. Vrbas (2004). **Age-related changes of the haematological profile in green iguana (*Iguana iguana rhinolopha*)**. *Acta Veterinaria Brno* 73(3): 305-312. ISSN: 0001-7213.
Online: http://vfu-www.vfu.cz/acta-vet/vol73/73-305.pdf
NAL Call Number: SF604.B7
Descriptors: reptiles, green iguana, *Iguana iguana rhinolopha*, hematological profile, age related changes, blood sample taking, red blood cell counts, white blood cell counts, hemoglobin concentration, mean corpuscular volume.

Pendl, H. (2006). **Morphologic changes in red blood cells of brids [birds] and reptiles and their interpretation.** *Israel Journal of Veterinary Medicine* 61(1): 2-11. ISSN: 0334-9152.
Online: http://www.isrvma.org/article/61_1_1.htm
NAL Call Number: 41.8 R25
Descriptors: reptiles, red blood cells, morphologic changes, birds, reptiles, interpretation, packed cell volume.

Peterson, M.E. (2006). **Snake bite: coral snakes.** *Clinical Techniques in Small Animal Practice* 21(4): 183-186. ISSN: 1096-2867.
NAL Call Number: QH600.C47
Descriptors: reptiles, dogs, cats, coral snakes, snake bites, venoms, toxicity, antivenoms, Micrurus, *Micruroides euryxanthus*, clinical techniques, USA.
Notes: In the special issue: Practical Toxicology / edited by K.T. Fitzgerald. Includes references.

Peterson, M.E. (2006). **Snake bite: pit vipers.** *Clinical Techniques in Small Animal Pactice* 21(4): 174-182. ISSN: 1096-2867.
NAL Call Number: QH600.C47
Descriptors: reptiles, *Crotalus*, *Elapidae*, snake bites, venoms , toxicity, antivenoms, United States.
Notes: In the special issue: Practical toxicology / edited by K.T. Fitzgerald. Includes references.

Petterino, C., M. Bedin, G. Podesta, and A. Ratto (2006). **Undifferentiated tumor in the ovary of a corn snake (*Elaphe guttata guttata*).** *Veterinary Clinical Pathology* 35(1): 95-100. ISSN: 0275-6382.
NAL Call Number: SF601.A54
Abstract: A 6-year-old intact female corn snake (*Elaphe guttata guttata*) was presented with a 3-week history of anorexia. Coelomic radiographs revealed a 9 x 4 cm soft tissue opacity suggestive of a right ovarian enlargement. The mass (9 x 5 x 4 cm) was surgically removed, and multiple smears from tissue sections were stained with Diff-Quik. Multiple tissue samples from the mass were collected and fixed in formalin. Cytologic specimens were moderately cellular and contained light pink amorphous background material. The cells were primarily spindle-shaped with moderate to marked anisocytosis and anisokaryosis. Cells sometimes were round to polygonal, and rarely were arranged in small clusters. Macrophages occasionally were observed. Histologic specimens consisted of a highly cellular mass composed of pleomorphic, spindle-shaped cells and, occasionally, round to polygonal cells arranged in irregular fascicles. The neoplastic cells were immunoreactive for cytokeratin (AE1/AE3), smooth muscle actin, and skeletal muscle actin, but did not stain for vimentin or desmin. On the basis of the morphologic and immunohistochemical results, a diagnosis of ovarian undifferentiated carcinoma was made. In this report, we describe the challenges of using immunohistochemistry to diagnose this uncommon type of tumor in reptiles.
Descriptors: reptiles, corn snake, ovary, undifferentiated tumor, anorexia, ovarian enlargement, coelomic radiographs, tumor, carcinoma.

Phillott, A.D., C.J. Parmenter, and S.C. McKillup (2006). **Calcium depletion of eggshell after fungal invasion of sea turtle eggs.** *Chelonian Conservation and Biology* 5(1): 146-149. ISSN: 1071-8443.
Descriptors: reptiles, sea turtle, *Caretta caretta*, depletion of eggshell, calcium depletion, fungal invasion, *Natator depressus*, *Eretmochelys imbricata*, *Chelonia mydas*, *Fusarium solani*.

Pospischil, A.S. (2003). **Novel chlamydiae in cats and reptiles.** *Abstracts of the General Meeting of the American Society for Microbiology* 103: Z-023. ISSN: 1060-2011.
Online: http://www.asmusa.org/mtgsrc/generalmeeting.htm
Descriptors: reptiles, chlamydia infection, cats, PCR assay, meeting abstracts.
Notes: Meeting Information: 103rd American Society for Microbiology General Meeting, Washington, DC, USA; May 18-22, 2003.

Pressler, B.M., R.A. Goodman, C.A. Harms, E.C. Hawkins, and G.A. Lewbart (2003). **Endoscopic evaluation of the esophagus and stomach in three loggerhead sea turtles (*Caretta caretta*) and a Malaysian giant turtle (*Orlitia borneensis*).** *Journal of Zoo and Wildlife Medicine* 34(1): 88-92. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Abstract: Three loggerhead sea turtles (*Caretta caretta*) and a Malaysian giant turtle (*Orlitia borneensis*) were presented with suspected or confirmed esophageal foreign bodies. Esophagoscopy was performed on all turtles, and gastroscopy was performed on three turtles. In all cases, endoscopy was easy to perform, and allowed visualization of most upper gastrointestinal features. The papillated esophagus was easy to navigate, but mucosal papillae in the loggerhead sea turtles prevented examination of the underlying mucosa. The stomach was easily entered and examined in both species, but the working endoscope length (100 cm) prevented inspection of the pyloric antrum and the duodenum in all turtles. The turtles in this report may serve as references for future endoscopic examinations of these species.
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, Malaysian giant turtle, *Orlitia borneensis*, endoscopic evaluation, stomach, esophagus, foreign bodies, gastrointestinal features , mucosa, pyloric antrum, duodenum, reference.

Raidal, S.R., P.L. Shearer, and R.I. Prince (2006). **Chronic shoulder osteoarthritis in a loggerhead turtle (*Caretta caretta*).** *Australian Veterinary Journal* 84(7): 231-234. ISSN: 0005-0423.
NAL Call Number: 41.8 Au72
Abstract: This report describes the lesions seen in an extremely weak and emaciated adult male loggerhead turtle (*Caretta caretta*) found stranded near Perth, Western Australia. Blood collected from a dorsal cervical sinus immediately prior to euthanasia demonstrated severe anaemia, markedly elevated plasma concentrations of creatinine kinase (2263 U/L), alkaline phosphatase (58 U/L), urea (18.1 mmol/L) and hypoglycaemia (glucose 0.7 mmol/L). Necropsy examination demonstrated a severe chronic osteoarthritis of the right shoulder joint with marked remodelling of the glenoid fossa, coracoid, scapula and humerus. There was marked synovial effusion and periarticular fibrosis. Cytological examination and culture of synovial fluid failed to demonstrate an infectious agent. Other findings were low numbers of trypanorhynch cysts present on the surface of the liver and numerous spirorchid eggs in

the attached mesentery. Several large and small spirorchid flukes were present in the heart and there was a localised endarteritis in the left aortic arch associated with this infection. Numerous nematode eggs and at least three species of spirorchid eggs were seen microscopically in faeces collected from the terminal colon. The pathogenesis and significance of these lesions is discussed.

Descriptors: loggerhead turtle, (*Caretta caretta*), male, stranded, post mortum, case study, osteoarthritis, shoulder joint pathology, alkaline phosphatase blood, blood glucose analysis, chronic disease, creatine kinase blood, fatal outcome, osteoarthritis diagnosis, osteoarthritis pathology, shoulder joint radiography, Western Australia.

Read, M.R. (2004). **Evaluation of the use of anesthesia and analgesia in reptiles.** *Journal of the American Veterinary Medical Association* 224(4): 547-552. ISSN: 0003-1488.

NAL Call Number: 41.8 Am3

Abstract: OBJECTIVE: To determine anesthetic techniques and the drugs used to provide anesthesia and analgesia to reptiles. DESIGN: Mail-out questionnaire. SAMPLE POPULATION: 367 members of the Association of Reptile and Amphibian Veterinarians. PROCEDURE: 1,091 members listed in the 2002 directory of the Association of Reptile and Amphibian Veterinarians were asked to complete a questionnaire regarding anesthesia and analgesia. RESULTS: 367 of 1,091 (33.6%) individuals completed the questionnaire; 88.8% used inhalants (particularly isoflurane) for anesthesia, and ketamine, propofol, and butorphanol were the most commonly used injectable agents. Intubation, fluids, and having a dedicated anesthetist were most commonly used for patient support, and pulse oximetry and Doppler ultrasonography were most commonly used for monitoring. Respiratory depression, difficulty monitoring anesthetic depth, prolonged recovery, and hypothermia were the most frequent complications. Nearly all respondents believed that reptiles feel pain, but analgesics were used infrequently for many reasons. CONCLUSIONS AND CLINICAL RELEVANCE: Providing anesthesia in reptiles is difficult, especially regarding anesthetic depth and vital parameters, and methods of support are used less frequently than in domestic species. Provision of analgesia is uncommon. Research regarding pain and its assessment, response to analgesics, and drug pharmacokinetics is needed. Dissemination of this information to practitioners needs to be improved for enhancement of the standard of care for reptiles.

Descriptors: reptiles, anesthesia, analgesia, evaluation of use, drugs, techniques, questionnaire, isoflurans, ketamine, propofol, butorphanol, inhalants, injectable, respiratory depression, hypothermia, prolonged recovery, depth of anesthesia.

Notes: Comment In: J Am Vet Med Assoc. 2004 Apr 15;224(8):1245; author reply 1245.

Reavill, D.R., M. Melloy, and R.E. Schmidt (2004). **Reptile mycotic infections from the literature and 55 cases.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 62-71. ISSN: 1529-9651.

NAL Call Number: SF996.A77

Descriptors: reptiles, Chelonia, Sauria, Serpentes, mycotic infections, fungal diseases, mycosis, infections, literature review.

Redrobe, S. (2002). **Reptiles and disease--keeping the risks to a minimum.** *Journal of Small Animal Practice.* 43(10): 471-472. ISSN: print: 0022-4510; online: 1748-5827.
NAL Call Number: 41.8 J8292
Descriptors: reptiles, animal husbandry, guidelines, zoonoses, *Salmonella* infections, prevention, control, tick borne diseases prevention, control.

Reichard, T. (2004). **Reptile quarantine.** *Iguana* 11(4): 247-249. ISSN: 1554-916X.
Descriptors: reptiles, quarentine, disease transmission, parasites.

Rice, A.N., J.P. Ross, A.G. Finger, and R. Owen (2005). **Application and evaluation of a stomach flushing technique for alligators.** *Herpetological Review* 36(4): 400-401. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: reptiles, *Alligator mississippiensis*, stomach flushing, safety, technique, application, evaluation.

Rival, F. (2004). **Trattamento chirurgico degli ascessi nei rettili. [Surgery for abscesses in reptiles].** *Summa* 21(3): 33-35. ISSN: 0100-5405.
Descriptors: reptiles, lizards, snakes, turtles, alligators, abscesses, surgery.
Language of Text: Italian; Summary in English.

Rival, F. (2003). **La chirurgia del prolasso cloacale nei rettili. [Surgery of the cloacal prolapse in iguanas].** *Summa* 20(6): 39-41, 2. ISSN: 0100-5405.
Descriptors: reptiles, iguanas, cloacal prolapse, surgery.
Language of Text: Italian.

Rogers, K.D. and D.T. Booth (2004). **A method of sampling blood from Australian freshwater turtles.** *Wildlife Research* 31(1): 93-95. ISSN: 1035-3712.
NAL Call Number: S960.W5
Descriptors: reptiles, freshwater turtles, *Chelodina expansa*, *Elseya latisternum*, *Emydura macquarii signata*, blood sampling method.

Rosenthal, K. (2004). **Reptile pain management - is there such a thing?** *Proceedings of the North American Veterinary Conference* 18: 1342. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, pain management, anesthesia, analgesia, drugs.
Notes: In the Volume: Small Animal and Exotics Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Rosenthal, K. (2004). **How to provide nutritional support to reptile patients**. *Proceedings of the North American Veterinary Conference* 18: 1349. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, nutritional support, veterinary medicine.
Notes: In the volume: Small Animal and Exotics. Book two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Rosenthal, K. (2004). **A new look at treatment of calcium: Phosphorus disorders in iguanas**. *Proceedings of the North American Veterinary Conference* 18: 1348. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, iguanas, calcium-phosphorus disorders.
Notes: In the volume: Small Animal and Exotics. Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Rosenthal, K. (2004). **Reptile compounding medication: What you should know**. *Proceedings of the North American Veterinary Conference* 18: 1346-1347. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, compounding medication, drug formulation.
Notes: In the volume: Small Animal and Exotics. Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Rosenthal, K. (2004). **How I treat stomatitis in reptiles**. *Proceedings of the North American Veterinary Conference* 18: 1345. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, stomatitis, treatment, veterinary medicine.
Notes: In the volume: Small Animal and Exotics. Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Rosenthal, K. (2004). **How to diagnose and treat a sick reptile when the owner has no money**. *Proceedings of the North American Veterinary Conference* 18: 1343-1344. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: sick reptile, cost of diagnosis and treatment, financial difficulties of client, veterinary medicine.
Notes: In the volume: Small Animal and Exotics. Book Two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Rosenthal, K.L. (2002). **Clinical pathology of the green iguana.** *Proceedings of the North American Veterinary Conference* 16(16): 940-942. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, Iguana, clinical aspects, clinical pathology, meeting.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Rosskopf, W.J.J. and M.K. Shindo (2003). **Syndromes and conditions of commonly kept tortoise and turtle species.** *Seminars in Avian and Exotic Pet Medicine* 12(3): 149-161. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: reptiles, tortoise, turtle, syndromes, conditons, common, captive pets.

Rueschoff, B., B. Christian, and D. Gruebner (2006). **Haeufige Erkrankungen bei Strumpfbandnattern. [Frequent illnesses of garter snakes.]**. *Draco* 7(1): 94-101 Nr 25. ISSN: 1439-8168.

Descriptors: reptiles, frequent illnesses, garter snakes, diseases, parasites, veterinary.
Language of Text: German.

Sand, M.A., K.S. Latimer, C.R. Gregory, P.M. Rakich, E. Jacobson, and K.E. Pennick (2004). **Molecular diagnosis of paramyxovirus infection in snakes using reverse transcriptase-polymerase chain reaction and complementary deoxyribonucleic acid:ribonucleic acid in situ hybridization.** *Journal of Veterinary Diagnostic Investigation* 16(5): 442-448. ISSN: 1040-6387.
NAL Call Number: SF774.J68
Descriptors: reptiles, snakes, paramyxovirus, infection, molecular diagnosis, reverse transcript polymerase chain reaction, complementary deoxyribonucleic acidribonucleic acid , in situ, hybridization.

Santoro, M., J.A. Morales, B. Stacy, and E.C. Greiner (2007). ***Rameshwarotrema uterocrescens* trematode parasitism of the oesophageal glands in green sea turtles (*Chelonia mydas*).** *Veterinary Record* 160(2): 59-60. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, *Chelonia mydas*, green sea turtles, esophageal diseases, Digenea, (Trematoda), trematode parasitism.

Santos, A.L.Q., T.S. Malta, A.V. Mundim, J.R.F. Alves Junior, and S.F.M. Carvalho (2005). **Variacao dos constituintes bioquimicos sanguineos de Tartarguas-da-Amazonia (*Podocnemis expansa*, Schweigger - 1812) (Testudinata) mantidas em criatorio comercial. [Blood biochemistry rates of South American river turtle (*Podocnemis expansa*, Schweigger - 1812) (Testudinata) bred in captivity.]**. *Archives of Veterinary Science* 10(3): 1-8. ISSN: 1517-784X.
Abstract: T
Descriptors: reptiles, South American river turtle, *Podocnemis expansa*, blood biochemistry rates, bred in captivity.
Language of Text: Portuguese; Summary in English and Portuguese.

Satorhelyi, T. (2004). **A terrariumi hullok vizsgalata. [Clinical and laboratory examinations of the terrarium reptiles].** *KisallatPraxis* 5(5): 200-206. ISSN: 1585-9142.
NAL Call Number: SF981.K573
Descriptors: reptiles, clinical examinations, laboratory examinations, terrarium reptiles, cardiovascular system, digestive system, respiratory system, urogenital system.
Language of Text: Hungarian; Summary in English.

Schildger, B.J. and W. Hafeli (2003). **Chirurgische Therapie der Dystokie bei Reptilien. [Surgical therapy of dystocia in reptiles].** *Tierarztliche Praxis Ausgabe K, Kleintiere/Heimtiere* 31(1): 41-48. ISSN: 1434-1239.
Descriptors: reptiles, dystocia, surgical therapy, diagnosis, methods.
Language of Text: German; Summary in English.

Schilliger, L. (2004). **Diagnosi delle alterazioni neurologiche nei rettili.[Diagnosis of neurological lesions in reptiles].** *Summa* 21(1): 31-34. ISSN: 0100-5405.
Descriptors: reptiles, diagnosis, snakes, lizards, turtles, neurological lesions.
Language of Text: Italian.

Schilliger, L. (2003). **L'insufficienza renale nell'iguana verde. [Renal failure in the green iguana (*Iguana iguana*)].** *Summa* 20(2): 47-50. ISSN: 0100-5405.
Descriptors: reptiles, green iguana, *Iguana iguana*, renal failure, kidney disease, veterinary.
Language of Text: Italian.

Schilliger, L., V. Chetboul, and D. Tessier (2005). **Standardizing two-dimensional echocardiographic examination in snakes.** *Exotic DVM* 7(3): 63-74. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, snakes, echocardiographic examination, two dimensional, standardizing, heart, veterinary.

Schillinger, L. (2004). **Lavagem traqueo-pulmonar em repteis. [Tracheo-pulmonar lavage in reptiles].** *A Hora Veterinaria*(141): 70-71. ISSN: 0101-9163.
Descriptors: reptiles, tracho pulmonar lavage, veterinary.
Language of Text: Portuguese; Summary in Italian and English.

Schillinger, L. (2004). **Il lavaggio tracheo-polmonare nei rettili. [Tracheoplumonary lavage in reptiles].** *Summa* 21(4): 75-77. ISSN: 0100-5405.
Descriptors: reptiles, tracheopulmonary lavage, respiratory diseases.
Language of Text: Italian.

Schroter, M., P. Roggentin, J. Hofmann, A. Speicher, R. Laufs, and D. Mack (2004). **Pet snakes as a reservoir for *Salmonella enterica* subsp. *diarizonae* (serogroup IIIb): A prospective study.** *Applied and Environmental Microbiology* 70(1): 613-615. ISSN: 0099-2240.
Online: http://dx.doi.org/10.1128/AEM.70.1.613-615.2004
NAL Call Number: 448.3 Ap5
Abstract: Reptile-associated *Salmonella* infections are an increasing problem for humans. We have prospectively screened two breeding groups of 16 pet snakes for colonization with *Salmonella* species. Various serovars of *S. enterica* subsp. *diarizonae* were found in 81% of the snakes. To avoid transmission, strict hygienic precautions should be applied when reptiles are handled.
Descriptors: reptiles, *Salmonella enterica* subsp. *diarizonae*, animal pathogenic bacteria, serotypes, isolation, feces, snakes, pets, Viperidae, disease reservoirs, salmonellosis, zoonoses, *Bitis nasicornis*, *Bothriechis schlegelii.*

Schroter, M., A. Speicher, J. Hofmann, and P. Roggentin (2006). **Analysis of the transmission of *Salmonella* spp. through generations of pet snakes.** *Environmental Microbiology* 8(3): 556-559. ISSN: print: 1462-2912; online: 1462-2920.
Abstract: Besides the 'classical' animals known as reservoirs for *Salmonella* spp., like poultry and cattle, reptiles have emerged as a significant source of human Salmonellae infections

during the last years. Reptile-associated Salmonellae frequently cause severe clinical courses including fatalities due to septicaemia and meningitis. Therefore, it is of major priority to develop measures which may help preventing cases of reptile-associated Salmonellae. However, as a first step the epidemiology of salmonellae in reptiles must be understood. Therefore, in this study a population analysis of the salmonellae of two female snakes was performed and the pattern of inheritance of Salmonellae to their offspring was investigated. It is demonstrated that adult snakes usually harbour a population of concurrent Salmonellae serovars. Colonization of their offspring during pregnancy and birth is a significant way of transmission causing 65% of the newborn to be positive for Salmonellae. The effectiveness of the transmission does not seem to be due only to the frequency of a certain serovar, because the most prevailing strain of one female snake was not detectable in any of her offspring.
Descriptors: *Salmonella* isolation and purification, *Salmonella* infections, animal transmission, snakes microbiology, bacterial typing techniques, disease transmission, vertical veterinary, *Salmonella* classification, serotyping.

Schumacher, J. (2002). **Sevoflurane in reptiles.** *Proceedings of the North American Veterinary Conference* 16(16): 950. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, inhaled anesthetics, sevoflurane, meeting, veterinary.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Schumacher, J. (2002). **Critical and supportive care of reptiles.** *Proceedings of the North American Veterinary Conference* 16(16): 944-945. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, intensive care, treatment , supportive care, veterinary, meeting.
Notes: In the volume: Small Animal and Exotics. Part of a three volume set. Meeting held January 12-16, 2002, Orlando, Florida. Includes references.

Schumacher, J. (2003). **Reptile respiratory medicine.** *Veterinary Clinics of North America, Exotic Animal Practice* 6(1): 213-231. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Respiratory tract disease is commonly diagnosed in captive collections of reptiles and associated with high morbidity and mortality. Improper environmental conditions are often contributing factors for the development of respiratory disease in reptiles. A detailed knowledge of the unique reptilian respiratory morphology and function is essential to successfully diagnose and treat respiratory disease. A variety of noninfectious and infectious causes have been identified in the etiology of reptile respiratory disease. Knowledge of the pathophysiology of reptilian diseases is increasing, and with the availability of new therapeutic agents and advanced diagnostic techniques, the diagnosis and treatment of reptile respiratory tract disease has become more successful.
Descriptors: reptiles, respiratory tract diseases veterinary, respiratory tract diseases diagnosis, respiratory tract diseases therapy.

Sladky, K.K., V. Miletic, J. Paul Murphy, M.E. Kinney, R.K. Dallwig, and S.M. Johnson (2007). **Analgesic efficacy and respiratory effects of butorphanol and morphine in turtles.** *Journal of the American Veterinary Medical Association* 230(9): 1356-1362. ISSN: 0003-1488.
NAL Call Number: 41.8 Am3
Abstract: OBJECTIVE: To test the hypothesis that butorphanol or morphine induces antinociception with minimal respiratory depression in conscious red-eared slider turtles. DESIGN: Prospective crossover study. ANIMALS: 37 adult male and female red-eared slider turtles (Trachemys scripta). PROCEDURES: Antinociception (n = 27 turtles) and respiratory (10 turtles) experiments were performed. Infrared heat stimuli were applied to the plantar surface of turtle limbs. Thermal withdrawal latencies were measured before and at intervals after SC administration of physiologic saline (0.9% NaCl) solution, butorphanol tartrate (2.8 or 28 mg/kg [1.27 or 12.7 mg/lb]), or morphine sulfate (1.5 or 6.5 mg/kg [0.68 or 2.95 mg/lb]). Ventilation was assessed in freely swimming turtles before and after SC administration of saline solution, butorphanol (28 mg/kg), or morphine (1.5 mg/kg). RESULTS: For as long as 24 hours after injection of saline solution or either dose of butorphanol, thermal withdrawal latencies among turtles did not differ. Low- and high-dose morphine injections increased latencies significantly by 8 hours. Ventilation was not altered by saline solution administration, was temporarily depressed by 56% to 60% for 1 to 2 hours by butorphanol (28 mg/kg) administration, and was significantly depressed by a maximum of 83 +/- 9% at 3 hours after morphine (1.5 mg/kg) injection. Butorphanol and morphine depressed ventilation by decreasing breathing frequency. CONCLUSIONS AND CLINICAL RELEVANCE: Although widely used in reptile species, butorphanol may not provide adequate antinociception for invasive procedures and caused short-term respiratory depression in red-eared slider turtles. In contrast, morphine apparently provided antinociception but caused long-lasting respiratory depression.
Descriptors: reptiles, turtles, analgesic efficacy, respiratory effects, butorphanol, morphine, antinociception, respiratory depression.

Soldati, G., Z.H. Lu, L. Vaughan, A. Polkinghorne, D.R. Zimmermann, J.B. Huder, and A. Pospischil (2004). **Detection of mycobacteria and Chlamydiae in granulomatous inflammation of reptiles: A retrospective study.** *Veterinary Pathology* 41(4): 388-397. ISSN: 0300-9858.
Online: http://www.vetpathology.org/cgi/content/abstract/41/4/388
NAL Call Number: 41.8 P27
Abstract: A retrospective study on reptile tissues presenting with granulomatous inflammation was performed to detect the possible presence of mycobacteria and Chlamydiae in these lesions. Ninety cases including 48 snakes, 27 chelonians, and 15 lizards were selected. Mycobacteria were detected by Ziehl-Neelsen (ZN) staining and a broad-range polymerase chain reaction (PCR) followed by DNA sequencing. To detect Chlamydiae, immunohistochemistry with monoclonal antibodies against chlamydial lipopolysaccharide (LPS) and a Chlamydiales order-specific PCR and sequencing were applied. Acid-fast bacilli were found in 14 cases (15.6%) by ZN staining and in 23 cases (25.6%) by PCR. Sequence analysis revealed the presence of Mycobacteria other than *Mycobacterium tuberculosis* complex (MOTT). Chlamydial LPS antigen was observed within granulomas from five samples (5.6%), whereas the PCR screen revealed 58 positive cases (64.4%). Of these, 9 cases (10%)

showed 98-99% similarity to Chlamydophila (Cp.) pneumoniae and 49 cases (54.4%) displayed a high similarity (88-97%) to the newly described "Chlamydia-like" microorganisms *Parachlamydia acanthamoebae* and *Simkania negevensis*. Results from this study confirm, on the one hand, that MOTT are probably the most important infectious etiology for granulomatous inflammation in reptiles. On the other hand, they indicate that chlamydia infects reptiles and that *Cp. pneumoniae* should be considered an etiological agent of granulomatous lesions of reptiles. Because both MOTT and *Cp. pneumoniae* are human pathogens, the potential of zoonotic transmission from reptiles to humans has to be considered. In contrast, the significance of Chlamydia-like isolates remains completely open, and further studies are needed to evaluate their role.

Descriptors: reptiles, mycobacteria, chlamydia, granulomatous inflammation, retrospective study, snakes, chelonians, lizards.

Soslau, G., D.A. Morgan, R. Class, F.V. Paladino, R. George, B. Whitaker, G.C. Violetta, S.J. Goldenberg, and J.R. Spotila (2003). **Coagulatin and platelet aggregation in sea turtles.** *NOAA Technical Memorandum NMFS SEFSC* 503: 306-307.

Descriptors: reptiles, sea turtles, coagulation, platelet aggregation, cardiovascular , blood.

Souza, M.J., K.E. Hall, J.D. Wilson, and G.A. Lewbart (2004). **Surgical removal of an artificial chicken egg from the gastrointestinal tract of a black rat snake, *Elaphe obsoleta*.** *Journal of Herpetological Medicine and Surgery* 14(4): 4-5. ISSN: 1529-9651.

NAL Call Number: SF997.5.R4 B85

Descriptors: reptiles, black rat snake, *Elaphe obsoleta*, artificial chicken egg, surgical removal, gastrointestinal tract, case report, anesthesia.

Spadola, F., M. Musico, F. Macri, M. Di Giancamillo, G. Costa, L. Siracusano, and G. Cucinotta (2004). **L'esame radiologico nei rettili: Nota III - Radiodiagnostica su 120 casi clinici. [Radiological examination in reptiles. Note III. Radiographic diagnosis in 120 clinical cases].** *Obiettivi e Documenti Veterinari* 25(5): 33-40. ISSN: 0392-1913.

Descriptors: reptiles, radiological examination, radiographic diagnosis, clinical cases, veterinary.

Language of Text: Italian; Summary in English.

Spadola, F., M. Musico, F. Macri, C. Interlandi, G. Costa, L. Siracusano, and G. Cucinotta (2003). **Nuovi animali da compagnia: applicazione clinica della cloacoscopia nei rettili e nei volatili. [Cloacoscopy in pet reptiles and birds].** *Summa* 20(1): 23-28. ISSN: 0100-5405.

Descriptors: reptiles, cloaca, endoscopy, pets, birds, cloacoscopy, veterinary procedures.

Language of Text: Italian.

Stahl, S.J. (2003). **Diseases of the reptile pancreas.** *Veterinary Clinics of North America, Exotic Animal Practice* 6(1): 191-212. ISSN: 1094-9194.

NAL Call Number: SF997.5.E95 E97

Abstract: A great deal of research is still needed to better understand the reptile pancreas especially with regard to diagnosis and treatment. However, vigilant clinicians and patholo-

gists have important roles to play in expanding our knowledge base in this field, and are encouraged to share their findings through publications and presentations.
Descriptors: reptiles, pancreatic diseases, veterinary , diagnosis, treatment.

Stahl, S.J. (2002). **Veterinary management of snake reproduction.** *Veterinary Clinics of North America, Exotic Animal Practice* 5(3): 615-636. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: The reptile veterinarian should approach the breeder with a comprehensive plan involving a review of proper husbandry, nutrition, record keeping, and a thorough prebreeding evaluation of the snakes. In addition, an evaluation of the reproductive strategy, assistance with confirming and monitoring gestation, and a review of potential reproductive complications will help to prepare the snake owner for a successful breeding season.
Descriptors: reptiles, husbandry, nutrition, review, record keeping, breeding, snake reproduction, veterinarian, evaluation, reproductive strategy.

Stahl, S.J. (2003). **Reptile cloacoscopy**. *Exotic DVM* 5(3): 57-60. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, anatomy, cloaca, diagnosis, diagnostic techniques, cloacoscopy, conference.
Notes: Meeting Information: International conference on exotics (ICE2003), Palm Beach, Florida, USA, 2003.

Stahl, S.J. (2005). **Rigid pnuemonoscopy [pneumonoscopy] and associated endosurgical techniques in snakes.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 12: 47-49. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: reptiles, snakes, rigid pneumonoscopy, associated endosurgical techniques, respiratory tract, trachea, lungs.

Stahl, S.J. (2005). **Cloacal endoscopy and associated endosurgical techniques in snakes.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 12: 44-46. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: reptiles, snakes, cloacal endoscopy, associated endosurgical techniques, diagnosis, conference proceedings.

Stahl, S.J. (2003). **Pet lizard conditions and syndromes.** *Seminars in Avian and Exotic Pet Medicine* 12(3): 162-182. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: reptiles, pet lizard, conditions, syndromes, disease, parasites, seminar, veterinary.

Stamper, M.A., M.G. Papich, G.A. Lewbart, S.B. May, D.D. Plummer, and M.K. Stoskopf (2003). **Pharmacokinetics of florfenicol in loggerhead sea turtles (*Caretta caretta*) after single intravenous and intramuscular injections.** *Journal of Zoo and Wildlife Medicine* 34(1): 3-8.

ISSN: 1042-7260.
NAL Call Number: SF601.J6
Abstract: The pharmocodynamics of single injections of florfenicol in yearling loggerhead sea turtles (*Caretta caretta*) were determined. Eight juvenile loggerhead sea turtles weighing 1.25 (+/- 0.18) kg were divided into two groups. Four animals received 30 mg/kg of florfenicol i.v., and four received the same dose i.m. Plasma florfenicol concentrations were analyzed by reverse-phase high performance liquid chromatography. After the i.v. dose, there was a biphasic decline in plasma florfenicol concentration. The initial steep phase from 3 min to 1 hr had a half-life of 3 min, and there was a longer slow phase of elimination, with a half-life that ranged from 2 to 7.8 hr among turtles. The volume of distribution varied greatly and ranged from 10.46 to -60 L/kg. Clearance after the i.v. dose was 3.6-6.3 L/kg/hr. After the i.m. injection, there was a peak within 30 min of 1.4-5.6 microg/ml, and florfenicol was thereafter eliminated with a half-life of 3.2-4.3 hr. With either route, florfenicol plasma concentrations were below the minimum inhibitory concentrations for sensitive bacteria within 1 hr. Florfenicol does not appear to be a practical antibiotic in sea turtles when administered at these doses.
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, florfenicol, pharmacokinetics, single injection, intravenous, intramuscular, plasma concentrations.

Sykes, J.M.4., J. Schumacher, J. Avenell, E. Ramsay, and G.B. Daniel (2006). **Preliminary evaluation of 99mTechnetium diethylenetriamine pentaacetic acid, 99mTechnetium dimercaptosuccinic acid, and 99mTechnetium mercaptoacetyltriglycine for renal scintigraphy in corn snakes (*Elaphe guttata guttata*).** *Veterinary Radiology and Ultrasound* 47(2): 222-227. ISSN: 1058-8183.
Abstract: The efficacy of three radiopharmaceuticals, 99mTc-diethylenetriaminepentaacetic acid (99mTc-DTPA), 99mTc-dimercaptosuccinic acid (99mTc-DMSA), and 99mTc-mercaptoacetyltriglycine (99mTc-MAG3), for renal imaging was examined in 16 corn snakes (*Elaphe guttata guttata*). All snakes received the radiopharmaceutical via an intracardiac injection. The kidneys could not be visualized in the three snakes that received 99mTc-DTPA or in the three snakes that received 99mTc-DMSA, but were well delineated in all 10 snakes receiving 99mTc-MAG3. These snakes were anesthetized and a dynamic frame mode acquisition was obtained for 30 min immediately following injection. A 60 s single static frame mode image was then obtained with the snake in a curled position. Two of the 10 snakes that received 99mTc-MAG3 were removed from further analysis because of suspected pericardial injections. Of the remaining eight snakes, the mean (+/- SD) renal uptake was 25 +/- 9.8% or 24 +/- 9.7%, with or without correction for residual injection site activity, respectively. Correction for remaining radioactivity in the heart does not appear to be necessary if it is less than 10% of the total dose. 99mTc-MAG3 provided consistently high quality images of the kidneys and further studies are warranted to evaluate its sensitivity for detecting decreased function in snakes with renal disease.
Descriptors: reptiles , corn snakes, *Elaphe guttata guttata*, kidney radionuclide imaging, radiopharmaceuticals, pharmacokinetics, snakes metabolism, heart, injections, kidney metabolism, radionuclide imaging, radiopharmaceuticals, administration, dosage, diagnostic use.

Sykes, J.M., L.L. Greer, E.C. Ramsay, and G.B. Daniel (2006). **Use of radiopharmaceuticals for renal imaging in green iguanas (*Iguana iguana*) and corn snakes (*Elaphe guttata guttata*).** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 13: 55-58. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: reptiles, green iguanas, *Iguana iguana*, corn snakes, *Elaphe guttata guttata*, renal imaging, radiopharmaceuticals, diagnosis, renal disease.

Sykes, J.M. and J.G. Trupkiewicz (2006). **Reptile neoplasia at the Philadelphia Zoological Garden, 1901-2002.** *Journal of Zoo and Wildlife Medicine* 37(1): 11-19. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, neoplasia, 1901-2002 necropsy reports, slides, veterinary, Philadelphia Zoological Garden.

Tandel, S.D., M.V. Wani, M.S. Karawale, and Y.R. Kaginkar (2003). **Treatment of subluxation in a rat snake**. *Zoos' Print* 18(10): 17. ISSN: print: 0971-6378; online: 0973-2543.
Descriptors: reptiles, rat snake, subluxation, case reports, clinical aspects, diagnosis, therapy.

Tell, L., S. Silverman, and E. Wisner (2003). **Imaging techniques for evaluating the head of birds, reptiles and small exotic mammals**. *Exotic DVM* 5(2): 31-37. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, birds, imaging techniques, evaluating the head, small exotic mammals.

Tell, L. and E. Wisner (2003). **Diagnostic techniques for evaluating the respiratory system of birds, reptiles and small exotic mammals**. *Exotic DVM* 5(2): 38-44. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, birds, small exotic mammals, diagnostic techniques, respiratory system, evaluation.

Tellez, S., V. Briones, S. Gonzalez, F.J. Garcia Pena, J. Altimira, A.I. Vela, M.M. Blanco, C. Ballesteros, J.F. Fernandez Garayzabal, and L. Dominguez (2002). ***Salmonella* septicaemia in a beauty snake (*Elaphe taeniura taeniura*).** *Veterinary Record* 151(1): 28-29. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, *Elaphe taeniura taeniura*, snakes , *Salmonella*, salmonellosis, septicemia, histopathology, liver, gall bladder, kidneys, intestines, case studies, clinical aspects, *Salmonella enterica*, subspecies, houtenae, subspecies, diarizonae.

Torrent, A., S. Deniz, A. Ruiz, P. Calabuig, J. Sicilia, and J. Oros (2002). **Esophageal diverticulum associated with *Aerococcus viridans* infection in a loggerhead sea turtle (*Caretta caretta*).** *Journal of Wildlife Diseases* 38(1): 221-223. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Abstract: A juvenile loggerhead sea turtle (*Caretta caretta*) stranded in Gran Canaria, Spain was necropsied. The turtle was underweight, had sunken eyes, and small amounts of crude oil were in the oral cavity. The most significant lesion was a large esophageal diverticulum

at the junction of the esophagus and stomach. The diverticulum was full of gas and green mucoid fluid and a diffuse thick yellow fibrinonecrotic membrane covered the mucosa. The lumen of the diverticulum also contained moderate numbers of cephalopods, crustaceans, and anthropogenic debris including crude oil balls, plastics, and fishing lines. Histologically there was a severe diffuse fibrinonecrotic esophagitis. *Aerococcus viridans* was isolated from the diverticulum. This is the first report of an esophageal diverticulum in a sea turtle. Although *A. viridans* is a known pathogen of lobsters and fishes, there are no reports of *A. viridans* infection in sea turtles.
Descriptors: reptiles, loggerhead sea turtles, *Caretta caretta*, esophageal diverticulum, *Aerococcus viridans*, cephalopods, debris, fishing lines.

Tuttle, A.D., M. Papich, G.A. Lewbart, S. Christian, C. Gunkel, and C.A. Harms (2006). **Pharmacokinetics of ketoprofen in the green iguana (*Iguana iguana*) following single intravenous and intramuscular injections**. *Journal of Zoo and Wildlife Medicine* 37(4): 567-570. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, green iguana, ketoprofen, pharmacokinetics, intravenous, intramuscular singular injections, daily dosing.

Valente, A.L., R. Cuenca, M.L. Parga, S. Lavin, J. Franch, and I. Marco (2006). **Cervical and coelomic radiologic features of the loggerhead sea turtle, *Caretta caretta*.** *Canadian Journal of Veterinary Research* 70(4): 285-290. ISSN: 0830-9000.
NAL Call Number: SF601.C24
Descriptors: reptiles, *Caretta caretta*, radiography, skeleton, endangered species, sea turtle, neck, vertebrae, carapace, plastron, scutes.
Language of Text: Summary in French.

Valente, A.L., R. Cuenca, M.A. Zamora, M.L. Parga, S. Lavin, F. Alegre, and I. Marco (2006). **Sectional anatomic and magnetic resonance imaging features of coelomic structures of loggerhead sea turtles.** *American Journal of Veterinary Research* 67(8): 1347-1353. ISSN: 0002-9645.
NAL Call Number: 41.8 Am3A
Abstract: OBJECTIVE: To compare cross-sectional anatomic specimens with images obtained via magnetic resonance imaging (MRI) of the coelomic structures of loggerhead sea turtles (*Caretta caretta*). ANIMALS: 5 clinically normal live turtles and 5 dead turtles. PROCEDURES: MRI was used to produce T1- and T2- weighted images of the turtles, which were compared with gross anatomic sections of 3 of the 5 dead turtles. The other 2 dead turtles received injection with latex and were dissected to provide additional cardiovascular anatomic data. RESULTS: The general view on the 3 oriented planes provided good understanding of cross-sectional anatomic features. Likewise, major anatomic structures such as the esophagus, stomach, lungs, intestine (duodenum and colon), liver, gallbladder, spleen, kidneys, urinary bladder, heart, bronchi, and vessels could be clearly imaged. It was not possible to recognize the ureters or reproductive tract. CONCLUSIONS AND CLINICAL RELEVANCE: By providing reference information for clinical use, MRI may be valuable for

detailed assessment of the internal anatomic structures of loggerhead sea turtles. Drawbacks exist in association with anesthesia and the cost and availability of MRI, but the technique does provide excellent images of most internal organs. Information concerning structures such as the pancreas, ureters, intestinal segments (jejunum and ileum), and the reproductive tract is limited because of inconsistent visualization.
Descriptors: loggerhead sea turtles, *Caretta caretta*, abdomen anatomy, histology, magnetic resonance imaging, turtles anatomy, histology, MRI.

Vancraeynest, D., F. Pasmans, A. Martel, K. Chiers, G. Meulemans, J. Mast, P. Zwart, and R. Ducatelle (2006). **Inclusion body disease in snakes: a review and description of three cases in boa constrictors in Belgium.** *Veterinary Record* 158(22): 757-761. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, snakes, Boa constrictor, cytoplasmic inclusions, animal diseases, case studies , inclusion body disease, Belgium.

Vasil'ev, D.B. and I. Solov'ev (2006). **[Ganglioneuroblastoma in Yemenite chameleon (*Chamaeleo calyptratus*): the first recorded case of a tumor of neuroectodermal histogenesis in reptiles]**. *Arkhiv Patologii* 68(4): 45-47 . ISSN: 0004-1955.
Abstract: Nerve tissue tumors are rarely encountered in reptiles and mainly represented by some documented cases of malignant peripheral nerve sheath tumor (MPNST). The paper is the first to describe a tumor mimicking MPNST by some ultrastructural features of tumor cells; however, significantly differing in the combination of immunohistochemical characteristics. Based on the data of electronic microscopy, immunohistochemistry, cytology, and histology, the tumor was classified as ganglioneuroblastoma. Since this nosological entity, unlike MPNST, cannot be assigned to a group of sarcomatoid tumors, the described pathology should be regarded as the first registered case of neuroectodermal histogenesis of tumors in reptiles.
Descriptors: ganglioneuroblastoma veterinary, lizards, chameleon, *Chamaeleo calyptratus*, ganglioneuroblastoma ultrastructure, nerve sheath neoplasms ultrastructure, nerve sheath neoplasms, veterinary.
Language of Text: Russian.

Vasilyev, D.B., Y.N. Solovyev, and V.N. Mitin (2003). **Bone tumors of reptiles.** *Voprosy Onkologii* 49(1): 81-84. ISSN: 0507-3758.
Descriptors: reptiles, bone tumors, disease.
Language of Text: Russian.

Vico, G.d., F. Marino, A. Sfacteria, F. Macri, R. Lorizio, V. Peretti, and B. Restucci (2003). **Invaginamento intestinale retrogrado in una tartaruga di mare (*Caretta caretta*). [Retrograde intestinal intussusception in a wild sea turtle (*Caretta caretta*)].** *Summa* 20(8): 49-51. ISSN: 0100-5405.
Descriptors: reptiles, wild sea turtle, *Caretta caretta*, intestinal intussuseption, surgery , case study.
Language of Text: Italian.

Visigalli, G. (2003). **Studio clinico sull'impiego e l'efficacia di un nuovo fluorchinolone, il difloxacin, nella medicina dei rettili.[Clinical study on efficaciousness of a new fluorquinolone (Difloxacin-DicuralReg.) in reptiles].** *Veterinaria Cremona* 17(1): 69-75. ISSN: 0391-3151.
Descriptors: reptiles, difloxacin, fluorquinolone, pharmacodynamics, efficaciousness, clinical study, veterinary.
Language of Text: Italian; Summary in English.

Wappel, S.M. and M.S. Schulte (2004). **Turtle care and husbandry.** *Veterinary Clinics of North America, Exotic Animal Practice* 7(2): 447-472. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Chelonians (turtles, tortoises, and terrapins) are not as well represented in private reptile collections as are snakes and lizards. This may be due in part to the fact that they often require more space and time for proper care. Nonetheless, they are still popular pets. Unfortunately, many people are not aware of what constitutes proper care for these animals. This article will discuss basic captive husbandry and nutrition issues of common chelonians, as well as recognizing illness, capture and restraint, sample collection, medication administration, and preventive care.
Descriptors: reptiles, turtles, tortoises, terrapins, care, husbandry, veterinary medicine, chelonians, private collections, pets.

Wellehan, J.F. and A.J. Johnson (2005). **Reptile virology.** *Veterinary Clinics of North America, Exotic Animal Practice* 8(1): 27-52. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Reptiles are hosts to diverse viral infections. This article reviews the viruses that are known to infect reptiles and discusses associated pathology, available diagnostic methods, and management techniques for the reptile clinician.
Descriptors: reptiles, virology, virus diseases, viruses isolation, purification, diagnosis, virus diseases, complications, diagnosis, prevention, control.

Wellehan, J.F.X., M. Lafortune, C. Gunkel, Rooney DelPino, Elijah, D.J. Heard, and E.R. Jacobson (2004). **Coccygeal vascular catheterization in lizards and crocodilians.** *Journal of Herpetological Medicine and Surgery* 14(2): 26-28. ISSN: 1529-9651.
NAL Call Number: SF997.5.R4 B85
Descriptors: reptiles, crocodilians, lizards, coccygeal vascular catheterization, fluid support, critical care, vascular access.

Westfall, M.E., D.L. Demcovitz, D.R. Plourde, D.S. Rotstein, and D.R. Brown (2006). **In vitro antibiotic susceptibility of *Mycoplasma iguanae* proposed sp. nov. isolated from vertebral lesions of green iguanas (*Iguana iguana*).** *Journal of Zoo and Wildlife Medicine* 37(2): 206-208. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, green iguana, *Iguana iguana*, *Mycoplaama iguana*, amtibiotic susceptibility, in vitro, vertebral lesions, isolated.

Wilson, S.C., H.W. Holder, J.M. Martin, T.L. Brasel, L.A. Andriychuk, C. Wu, D.C. Straus, and R. Aguilar (2006). **An indoor air quality study of an alligator (*Alligator mississippiensis*) holding facility.** *Journal of Zoo and Wildlife Medicine* 37(2): 108-115. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: reptiles, alligators, *Alligator mississippiensis*, holding facility, indoor air quality, study, contamination, mortality, fungal, microbial.

Work, T.M., G.H. Balazs, R.A. Rameyer, and R.A. Morris (2004). **Retrospective pathology survey of green turtles *Chelonia mydas* with fibropapillomatosis in the Hawaiian Islands, 1993--2003.** *Diseases of Aquatic Organisms* 62(1-2): 163-176. ISSN: print: 0177-5103; online: 1616-1580.
Online: http://dx.doi.org/10.3354/dao062163
Abstract: We necropsied 255 stranded green turtles *Chelonia mydas* with fibropapillomatosis (FP) from the Hawaiian Islands, North Pacific, from August 1993 through May 2003. Of these, 214 (84 %) were euthanized due to advanced FP and the remainder were found dead in fresh condition. Turtles were assigned a standardized tumor severity score ranging from 1 (lightly tumored) to 3 (heavily tumored). Tumors were counted and measured and categorized as external, oral, or internal and tissues evaluated by light microscopy. Turtles in tumor score 2 and 3 categories predominated, and tumor score 3 turtles were significantly larger than the other 2 categories. More juveniles stranded than subadults or adults. Total cross-sectional area of tumors increased significantly with straight carapace length (SCL). Frequency distribution of total number of external tumors per turtle was significantly skewed to the right, and there were significantly more tumors at the front than rear of turtles. Eighty percent of turtles had oral tumors, and 51% of turtles with oral tumors had tumors in the glottis. Thirty-nine percent of turtles had internal tumors, most of them in the lung, kidney and heart. Fibromas predominated in lung, kidney and musculoskeletal system whereas myxofibromas were more common in intestines and spleen. Fibrosarcomas of low-grade malignancy were most frequent in the heart, and heart tumors had a predilection for the right atrium. Turtles with FP had significant additional complications including inflammation with vascular flukes, bacterial infections, poor body condition, and necrosis of salt gland. Turtles with oral tumors were more likely to have secondary complications such as pneumonia. Most turtles came from the island of Oahu (74%) followed by Maui (20 %), Hawaii, Molokai, and Lanai (<3 % each). On Oahu, significantly more turtles we necropsied stranded along the northwestern and northeastern shores.
Descriptors: reptiles, green turtles, *Chelonia mydas*, fibropapillomatosis, pathology survey, necropsy, Hawaiian Islands.

Work, T.M., G.H. Balazs, M. Wolcott, and R. Morris (2003). **Bacteraemia in free-ranging Hawaiian green turtles *Chelonia mydas* with fibropapillomatosis.** *Diseases of Aquatic Organisms* 53(1): 41-46. ISSN: print: 0177-5103; online: 1616-1586.
Online: http://dx.doi.org/10.3354/dao053041
Abstract: Past studies of free-ranging green turtles *Chelonia mydas* with fibropapillomatosis (FP) in Hawaii have shown that animals become immunosuppressed with increasing severity of this disease. Additionally, preliminary clinical examination of moribund turtles with FP

revealed that some animals were also bacteraemic. We tested the hypothesis that bacteraemia in sea turtles is associated with the severity of FP. We captured free-ranging green turtles from areas in Hawaii where FP is absent, and areas where FP has been endemic since the late 1950s. Each turtle was given an FP severity score ranging from 0 (no tumours) to 3 (severely affected). A fifth category included turtles that were stranded ashore and moribund with FP. We found that the percentage of turtles with bacteraemia increased with the severity of FP, and that the majority of bacteria cultured were Vibrio spp. Turtles with severe FP were more susceptible to bactaeremia, probably in part due to immunosuppression. The pattern of bacteraemia in relation to severity of disease strengthens the hypothesis that immunosuppression is a sequel to FP.
Descriptors: reptiles, Hawaiian green turtles, *Chelonia mydas*, bacteraemia , free ranging, fibropapillomatosis, immunosuppressed, tumors, clinical examination.

Wosar, M.A. and G.A. Lewbart (2006). **Ileocolic intussusception in a pine snake (*Pituophis melanoleucus*).** *Veterinary Record* 158(20): 698-699. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: reptiles, pine snakes, *Pituophis melanoleucus*, digestive system, diseases, iliocolic intussusception, surgery.

Wright, K. (2005). **Beyond POTZ: environmental influences on reptile healing.** *Exotic DVM* 7(4): 11-15. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: reptiles, healing, environmental influences, temperature, stress.

Wu, H.X. (2004). **Identification and inhibitory effects of drugs against pathogenic bacteria of soft-shelled turtle (*Trionyx sinensis*) in vitro.** *Fisheries Science Liaoning* 23(6): 5-9. ISSN: 1003-1111.
Descriptors: reptiles, soft shelled turtle, *Trionyx sinensis*, pathogenic bacteria, drugs against, inhibitory effects, identification.
Language of Text: Chinese; Summary in Chinese and English.

Wu, H.X. and J.Z. Xue (2004). **Pathogens of haemorrhagic intestinal necrosis in soft-shelled turtle (*Trionyx sinensis*) and their drug sensitivity.** *Chinese Journal of Veterinary Science* 24(4): 343-345 Sum No 112. ISSN: 1005-4545.
NAL Call Number: SF604.C58
Descriptors: reptiles, soft shelled turtle, *Trionyx sinensis*, pathogens, hemorrhagic intestinal necrosis, drug sensitivity.
Language of Text: Chinese; Summary in Chinese and English.

Wyneken, J. and D. Mader (2004). **Clinical applications: Reptile skeletal system**. *Proceedings of the North American Veterinary Conference* 18: 1358-1360. ISSN: 0003-1488.
NAL Call Number: SF605.N672
Descriptors: reptiles, anatomy, skeletal system, bone fractures, cartilage, fracture fixation, ligaments, musculoskeletal system, surgery.

Notes: In the volume: Small Animal and Exotics. Book two: Pain Management - Zoonosis. Meeting held January 17-21, 2004, Orlando, Florida.

Zwart, P. (2006). **Renal pathology in reptiles.** *Veterinary Clinics of North America, Exotic Animal Practice* 9(1): 129-159. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: The class of Reptilia varies widely. Both the gross morphology and microscopic anatomy of the kidneys are specific for each species.In each species of reptile, the physiology of the renal system has adapted to the specific conditions of life, including, among other factors, the type of food, environmental temperature, and the availability of water. The pathology of the kidneys in reptiles has been poorly studied, but in recent years a number of investigators have specifically studied reptilian renal pathology.
Descriptors: reptiles, kidney pathology, kidney diseases, kidney abnormalities, kidney physiopathology, kidney diseases, pathology.

Web Resources

All resources are accessible through the internet and are current as of September 2008. Readers are cautioned as to the dynamic nature of the internet and the fact that addresses and content are subject to change.

Bibliomania! Herpetological Literature.
Online: http://www.herplit.com/
Description: The HerpLit Database consists of approximately 50,000 citations dating from 1586 to the present and can be accessed by the buttons on the left side of the page.

Iguana Specialist Group. *The World Conservation Union (IUCN)*.
Online: http://www.iucn-isg.org/index.php
Description: This international group seeks to help design and implement effective conservation measures for iguanas. Their action plan provides information on marking techniques, reintroduction guidelines, translocation, and population monitoring. The group also provides captive managment guidelines for the following species:
* Rock Iguanas (Cyclura) - http://www.iucn-isg.org/actionplan/ch3/captivemanagement_cyclura.php
* Lesser Antillian Iguana (Iguana delicatissima) - http://www.iucn-isg.org/actionplan/ch3/captivemanagement.php

Society for the Study of Amphibians and Reptiles.
Online: http://ssarherps.org/
Description: SSAR is an organization established to advance research, conservation, and education concerning reptiles and amphibians.

The Insitute for Genomic Research (TIGR) Reptile Databse.
Online: http://www.reptile-database.org/
Description: Provides a source for the taxonomic data of all living reptiles.

The Center for North American Herpetology.
Online: http://www.cnah.org/index.asp
Description: This web site contains information about North American amphibians, turtles, reptiles, and crocodilians, and promotes the study and conservation of them.

Tuatara Captive Management Plan and Husbandry Manual (PDF, 773 KB). *Barbara Blanchard, W.Z. Tuatara Recovery Group within the New Zealand Department of Conservation*.
Online: http://www.doc.govt.nz/upload/Conservation/PDF/Tuatara-Captive-Management-Plan.pdf
Description: Provides information on breeding and reintroduction programs, taxonomy, natural history, housing, husbandry, and veterinary care of tuataras in captivity.

Information Resources for Reptiles, Amphibians, Fish, and Cephalopods Used in Biomedical Research, 1995. *Berry, D.J. and Michael D. Kreger. USDA. Animal Welfare Information Center.*
Online: http://www.nal.usda.gov/awic/pubs/oldbib/reptiles.htm
Description: This document contains information on the care and use of many alternative animal models and serves as an introduction to these species.

Ban on Interstate and Intrastate Sales and Distribution of Small Turtles. *DHHS. FDA. Office of Regulatory Affairs.*
Online: http://www.fda.gov/ora/compliance_ref/cpg/cpggenl/cpg170-100.html
Description: Code of Federal Regulations banning the sale or commercial distribution of viable turtle eggs and small turtles for use as pets.

Recommendations for the Care of Amphibians and Reptiles in Academic Institutions. *F. Harvey Pough*.
Online: http://netvet.wustl.edu/species/reptiles/pough.txt
Description: This 1992 publication From the National Academies Presscovers the biology of amphibians and reptiles, recommendations for the physical and biological environment of ectotherms, marking individuals, breeding, medical care, and health precautions for animals and caretakers.

Crocodilian, Tuatara, and Turtle Species of the World: An Online Taxonomic and Geographical Reference. *King, F.W. and R.L. Burke*.
Online: http://www.flmnh.ufl.edu/natsci/herpetology/turtcroclist/
Description: An internet version of a 1989 book entitled: *Crocodilian, Tuatara, and Turtle Species of the World: A Taxonomic and Geographic Reference* made available by the Association of Systematics Collections.

Comfortable Quarters for Reptiles and Amphibians in Research Institutions. *Kreger, M.D.*
Online: http://www.awionline.org/pubs/cq02/Cq-amph.html
Description: Discusses basic species-specific biology, replicating important features

of the natural environment in the housing and care provided to the animals in the laboratory, and recognizing signs of pain and distress.

Rules for Using Reptiles for Research and Teaching. *Lawrence H. Herbst*.
Online: http://campusvet.wsu.edu/infofac/reptileregulations.htm
Description: This reference brief discusses rules and regulations as they pertain to captive reptiles used in research and teaching in the United States.

Bibliography of Pain and Analgesia in Herps. *Melissa Kaplan*.
Online: http://www.anapsid.org/herppainbiblio.html
Description: This bibliography was last updated in 2007.

Social Ethogram of *Anolis carolinensis*. *Neil Greenberg . University of Tennessee*.
Online: https://notes.utk.edu/Bio/greenberg.nsf/63bbb8a8bd4c0eef852563ed0072e463/086a04290e49e24885256b0a00497920?OpenDocument
Description: This chart provides information on social behaviors of the green anole (lizard), *Anolis carolinensis*.

Care and Use of *Anolis carolinensis*. *Neil Greenberg. University of Tennessee, Knoxville*.
Online: https://notes.utk.edu/Bio/greenberg.nsf/d8562c8c8efe0a2c852563ef0047cd59/136845d1d67ff9d58525646000615b71?OpenDocument
Description: Gneral guidelines for the care and handling of captive green anoles maintained for research purposes.

Cold-blooded Vertebrates as Animal Models. *Susan E. Wilson-Sanders. University of Arizona*.
Online: http://www.uac.arizona.edu/VSC443/coldblood/Cold_blooded_Verteb_as_animal_models07.htm
Description: These class lecture notes provide information on regulations and guidelines, zoonoses, and use of fish, reptiles and amphibians in research environments.

Amphibians, Fish & Reptiles Used in Biomedical Research. *USDA. NAL. Animal Welfare Information Center.*
Online: http://www.nal.usda.gov/awic/pubs/amphib.htm