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United States Department of Agriculture

Agricultural Research Service

National Agricultural Library

Animal Welfare Information Center

Information Resources on Amphibians

September 2008

Red-eyed Treefrog (*Agalychnis callidryas*)

Photo credit: John J. Mosesso/NBII.Gov

AWIC Resource Series No. 42

United States Department of Agriculture

Agricultural Research Service

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September 2008

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The Animal Welfare Information Center (AWIC) is part of the National Agricultural Library, which is located in Beltsville, Maryland. Established in 1986 as mandated by amendments to the Animal Welfare Act, AWIC provides information for improved animal care and use in research, teaching, and testing.

About this Document

This publication updates and revises the amphibian 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 amphibians 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.

U.S. Customs controls the import and export of animals and animal products through US ports. Importers and exporters of all tortoises and terrapins as well as other reptiles and amphibians must obtain clearance from the U.S. Fish and Wildlife Service.

Also note, the global decline in wild amphibians is of concern to scientists. Reasons for the declines are still poorly understood. This document contains numerous research papers about declining amphibian populations.

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

Birinyi, A., G. Szekely, K. Csapo, and C. Matesz (2004). **Quantitative morphological analysis of the motoneurons innervating muscles involved in tongue movements of the frog *Rana esculenta*.** *Journal of Comparative Neurology* 470(4): 409-421. ISSN: 0021-9967.
Descriptors: amphibians, frog, tongue movements, innervating muscles, morphological analysis, protractor, retractor, inner, prey catching.

Burton, T.C. (2004). **Muscles of the pes of hylid frogs.** *Journal of Morphology* 260(2): 209-233. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: hylid frogs, pes muscles, dissection, foot musculature.

Chan, T. and M. Asashima (2006). **Growing kidney in the frog.** *Nephron. Experimental Nephrology* 103(3): E81-E85. ISSN: print: 1660-2129; online: 1660-2129.
Descriptors: frog, growing kidney, embryology, *Xenopus laevis* embryology, kidney development, renal organs.

Ehmcke, J., G. Clemens, and H. Greven (2002-2003). **Oviductal anatomy and histology of five species of Neotropical plethodontid salamanders (Urodela, Amphibia).** *Acta Biologica Benrodis* 12(1-2): 1-17. ISSN: 0177-9214.
Descriptors: Neotropical plethodontid salamanders, amphibians, oviductal anatomy, histology, comparative study , five species, Urodela, Amphibia.
Language of Text: English; German.

Fang, Z.q. (2006). **Ultrastructure of liver of Chinese giant salamander, *Andrias davidianus*.** *Sichuan Journal of Zoology* 25(2): 228-230. ISSN: 1000-7083.
Descriptors: Chinese giant salamander, *Andrias davidianus*, liver, ultrastructure.
Language of Text: Chinese; Summary in Chinese and 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.

Gonzalez Elorrlaga, M.A. and G. Canepa (2002). **Evidencias que sugieren una asociacion microanatomica mastocito-nervio en la lengua del sapo *Bufo marinus* demostradas mediante microscopia de luz de alta resolucion. [Suggestive evidences for a microanatomical relationship between mast cells and nerve in the tongue of the toad *Bufo marinus* dem-**

onstrated by means of high resolution light microscopy.]. *Acta Cientifica Venezolana* 53(4): 258-265. ISSN: 0001-5504.
Descriptors: toad, *Bufo marinus*, mast cells, nerve, tongue, microanatomical relationship, high resolution light microscopy.
Language of Text: Spanish; Summary in English and Spanish.

Huang He and Bai XiuJuan (2003). **Anatomical histological observation of reproductive organs of medicinal forest frog**. *Journal of Economic Animal* 7(2): 47-49. ISSN: 1007-7448.
Descriptors: amphibians, medicinal forest frog, reproductive organs, anatomy, ovaries, oviducts, testes, uterus, histological observation.
Language of Text: Chinese; Summary in English.

Kupfer, A., H. Muller, M.M. Antoniazzi, C. Jared, H. Greven, R.A. Nussbaum, and M. Wilkinson (2006). **Parental investment by skin feeding in a caecilian amphibian.** *Nature* 440(7086): 926-929. ISSN: print: 0028-0836; online: 1476-4687.
NAL Call Number: 472 N21
Abstract: Although the initial growth and development of most multicellular animals depends on the provision of yolk, there are many varied contrivances by which animals provide additional or alternative investment in their offspring. Providing offspring with additional nutrition should be favoured by natural selection when the consequent increased fitness of the young offsets any corresponding reduction in fecundity. Alternative forms of nutrition may allow parents to delay and potentially redirect their investment. Here we report a remarkable form of parental care and mechanism of parent-offspring nutrient transfer in a caecilian amphibian. *Boulengerula taitanus* is a direct-developing, oviparous caecilian, the skin of which is transformed in brooding females to provide a rich supply of nutrients for the developing offspring. Young animals are equipped with a specialized dentition, which they use to peel and eat the outer layer of their mother's modified skin. This new form of parental care provides a plausible intermediate stage in the evolution of viviparity in caecilians. At independence, offspring of viviparous and of oviparous dermatotrophic caecilians are relatively large despite being provided with relatively little yolk. The specialized dentition of skin-feeding (dermatophagous) caecilians may constitute a preadaptation to the fetal feeding on the oviduct lining of viviparous caecilians.
Descriptors: *Boulengerula taitanus*, amphibia anatomy and histology, animal nutrition, mothers, skin anatomy and histology, oviparity, selection genetics, tooth anatomy and histology.

Laberge, F., S. Muhlenbrock Lenter, W. Grunwald, and G. Roth (2006). **Evolution of the amygdala: new insights from studies in amphibians.** *Brain, Behavior and Evolution* 67(4): 177-187. ISSN: 0006-8977.
Abstract: The histology of amphibian brains gives an impression of relative simplicity when compared with that of reptiles or mammals. The amphibian telencephalon is small and contains comparatively few and large neurons, which in most parts constitute a dense periventricular cellular layer. However, the view emerging from the last decade is that the brains of all tetrapods, including amphibians, share a general bauplan resulting from

common ancestry and the need to perform similar vital functions. To what extent this common organization also applies to higher brain functions is unknown due to a limited knowledge of the neurobiology of early vertebrates. The amygdala is widely recognized as a brain center critical for basic forms of emotional learning (e.g., fear conditioning) and its structure in amphibians could suggest how this capacity evolved. A functional systems approach is used here to synthesize the results of our anatomical investigations of the amphibian amygdala. It is proposed that the connectivity of the amphibian telencephalon portends a capacity for multi-modal association in a limbic system largely similar to that of amniote vertebrates. One remarkable exception is the presence of new sensory-associative regions of the amygdala in amniotes: the posterior dorsal ventricular ridge plus lateral nuclei in reptiles and the basolateral complex in mammals. These presumably homologous regions apparently are capable of modulating the phylogenetically older central amygdala and allow more complex forms of emotional learning.
Descriptors: amphibia physiology, amygdala physiology, evolution, limbic system physiology, thalamus cytology, thalamus physiology.

Li, M.h., W. Li, W. Zhou, Q. Zhang, and F.l. Li (2006). **Comparative anatomy of respiratory system of three frogs and discussion on their evolutive relationship.** *Sichuan Journal of Zoology* 25(2): 223-227. ISSN: 1000-7083.
Descriptors: amphibians, frogs, respiratory system, comparative anatomy, discussion, evolution.
Language of Text: Chinese; Summary in Chinese and English.

Mali, L.B. and B. Bulog (2004). **Histology and ultrastructure of the gut epithelium of the neotenic cave salamander, *Proteus anguinus* (Amphibia, Caudata).** *Journal of Morphology* 259(1): 82-89. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: amphibians, neotenic cave salamander, *Proteus anguinus*, gut epithelium, histology, ultrastructure.

Norris, D.O. and K.H. Lopez (2005). **Anatomy of the amphibian endocrine system.** *Amphibian Biology* 6: 2021-2044.
Descriptors: amphibians, endocrine system, anatomy.

O'Malley, B. (2005). ***Clinical Anatomy and Physiology of Exotic Species: Structure and Function of Mammals, Birds, Reptiles and Amphibians.***, Elsevier Saunders: Edinburgh and New York, 269 p. ISBN: 0702027820.
NAL Call Number: SF997.5.E95 O44 2005
Descriptors: amphibians, birds, reptiles, mammals, clinical anatomy, physiology, exotic animals.

Okuda Akabane, K., H. Fukami, K. Narita, and Y. Kitada (2006). **Membrane excitability of wing and rod cells in frog taste discs following denervation.** *Brain Research* 1103(1): 145-149. ISSN: 0006-8993.

Abstract: The frog tongue has a disc-shaped taste organ (taste disc) on the top of fungiform papillae. The taste disc contains two types of cells, wing cells with a sheet-like apical process and rod cells with a rod-like apical process. Both wing and rod cells can produce action potentials. Unlike the taste buds of mammals, frog taste discs do not degenerate over a long period after denervation. Here we report that the shapes of wing and rod cells isolated from taste discs in the bullfrog (*Rana catesbeiana*) remained unchanged 1 month after cutting bilateral glossopharyngeal nerves. By applying the whole cell patch-clamp technique to isolated wing and rod cells, we found voltage-dependent inward currents and outward currents and action potentials in denervated frogs as seen in normal frogs. These results suggest that the maintenance of morphological integrity and electrical excitability of taste cells does not require a nerve supply in frogs.
Descriptors: frog, *Rana catesbeiana*, neurons, afferent physiology, taste physiology, tongue innervation, action potentials physiology, cell membrane physiology, cell separation, cell shape, denervation, electric stimulation, glossopharyngeal nerve physiology, ion channel gating physiology, membrane potentials physiology, neurons, afferent ultrastructure, patch clamp techniques, potassium physiology, sodium channels physiology.

Pickering, M., D. Campion, and J.F.X. Jones (2004). **A gastrointestinal role for the amphibian 'diaphragm' of *Xenopus laevis*.** *Journal of Zoology* 264(1): 45-51. ISSN: 0952-8369.
Descriptors: amphibians, frog, *Xenopus laevis*, diaphragm, gastrointestinal role.

Riad I, A.M. and M.A. Mosaibih (2004). **Anatomical studies on the ontogeny of the chondral neurocranium and splanchnocranium during larval metamorphosis of an anuran amphibian (*Xenopus laevis*): I - intermediate stage.** *Journal of the Egyptian German Society of Zoology* 43(B): 65-91. ISSN: 1110-5356.
NAL Call Number: QL1.E49
Descriptors: amphibians, anuran, *Xenopus laevis*, anatomical studies, chondral neurocranium, splanchnocranium, larval metamorphosis.
Language of Text: Arabic; English.

Shearman, R.M. (2003). **The frog pectoral girdle: a non-amniote model of bone formation.** *SICB Annual Meeting and Exhibition Final Program and Abstracts* 2003: 301. ISSN: print: 1540-7063; online: 1557-7023.
Descriptors: amphibians, frog, pectoral girdle, bone formation, non amniote model, meeting.
Notes: Meeting Information: Annual Meeting and Exhibition of the SICB (Society for Integrative and Comparative Biology), Toronto, ON, Canada; January 04-08, 2003.

Simmons, D.D., S.W.F. Meenderink and P.N. Vassilakis (2007). **Anatomy, physiology, and function of auditory end-organs in the frog inner ear**. In: *Springer Handbook of Auditory Research.* Vol. 28, Springer: New York, NY, p. 184-220. ISBN: 0387325212.
Descriptors: amphibians, frog, auditory end organs, inner ear, functions, anatomy, physiology, book chapter.

Smirnov, S.V. and A.B. Vassilieva (2002). **Skeletal and dental ontogeny in the long-tailed clawed salamander, *Onychodactylus fischeri* (Urodela: Hynobiidae).** *Russian Journal of Herpetology* 9(1): 21-32. ISSN: 1026-2296.
Descriptors: amphibians, salamander, *Onychodactylus fischeri*, skeleton, morphology, ontogeny, dentition, skull, development.

Srivastava, U.C. and S. Srivastava (2002). **Ventral root projections in the spinal cord in frog *R. tigrina*.** *Proceedings of the National Academy of Sciences India Section B Biological Sciences* 72(2): 169-172. ISSN: 0369-8211.
NAL Call Number: Q73.N311
Descriptors: frog, *Rana tigrina*, spinal cord, ventral root projections.

Straka, H. and E. Gilland (2002). **Anatomical and functional organization of the vestibular commissure in frogs.** *Society for Neuroscience Abstract Viewer and Itinerary Planner.* 2002: Abstract No. 564.19. ISSN: 0190-5295.
Online: http://sfn.scholarone.com
Descriptors: amphibians, frogs, vestibular commissure, anatomy, brainstem, vestibular neurons.
Notes: Meeting Information: 32nd Annual Meeting of the Society for Neuroscience, Orlando, FL, USA; November 2-7, 2002.

Vassilieva, A.B. (2005). **The dental system of urodelan amphibians and the role of thyroid hormones in its metamorphic remodelling.** *Russian Journal of Herpetology* 12(Suppl.): 312-314. ISSN: 1026-2296.
Descriptors: amphibians, urodela, dental system, role of thyroid hormones, jaws, metamorphic remodeling.

Wilczynski, W. and H. Endepols (2007). **Central auditory pathways in anuran amphibians: the anatomical basis of hearing and sound communication**. In: *Springer Handbook of Auditory Research.* Vol. 28, Springer: New York, NY, p. 221-249. ISBN: 0387325212.
Descriptors: amphibians, hearing, sound communication, central auditory pathways, anatomical basis, book chapter.

Yu, S.Y., K.Y. Si, Z.H. Liu, Z.R. Wang, and J.L. Wang (2004). **Compare observation on the microvascular casts of the lungs of lizard and toad.** *Journal of the Northwest Normal University Natural Sciences* 40(2): 55-58. ISSN: 1001-988X.
Descriptors: lizard, toad, amphibians, *Bufo raddei*, blood vessels, lungs, microvascular casts.
Language of Text: Chinese; Summary in Chinese and English.

Yue, X.J., Y.G. Zhang, and Z.J. Wang (2002). **The histology and histo-chemistry studies of the digestive tract of the toad in China, *Bufo gargariizans*.** *Journal of Southwest China Normal University Natural Science* 27(3): 383-389; No 120. ISSN: 1000-5471.
Descriptors: toad, *Bufo gargariizans*, biochemistry, digestive system, digestive tract, anatomy, histology and histochemistry.
Language of Text: Chinese; Summary in Chinese and English.

Anesthesia and Analgesia

Andersen, J.B. and T. Wang (2002). **Effects of anaesthesia on blood gases, acid-base status and ions in the toad *Bufo marinus*.** *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 131A(3): 639-646. ISSN: 1095-6433.
Descriptors: *Bufo marinus*, toad, blood sampling, sedation, anesthesia, acid base status and ions, blood acid base status and ion balance, blood, respiratory gas transport, benzocaine.

Brown, H.H.K., H.K. Tyler, and T.A. Mousseau (2004). **Orajel[registered trademark] as an amphibian anesthetic: refining the technique.** *Herpetological Review* 35(3): 252. ISSN: 0018-084X.
NAL Call Number: QL640.H47**Descriptors:** *Notophthalmus viridescens dorsalis*, newt, salamander, sedation, Orajel registered trademark, use as anaesthetic, refining the technique.

Buyukakilli, B., U. Comelekoglu, C. Tataroglu, and A. Kanik (2003). **Reversible conduction block in isolated frog sciatic nerve by high concentration of bupivacaine.** *Pharmacological Research* 47(3): 235-241. ISSN: 1043-6618.
Abstract: We evaluated the effects of a high concentration of bupivacaine commonly used for spinal anaesthesia on the reversibility of conduction block and compound nerve action potential (CNAP) parameters in isolated frog sciatic nerve measured by extracellular recording technique. Isolated frog sciatic nerves were bathed in 1.3% bupivacaine solution for 20 min. In each nerve, action potentials were recorded before exposure to bupivacaine solution, which served as the control data. The extracellular action potentials were recorded after 20 min in the drug by using a BIOPAC MP 100 Acquisition System Version 3.5.7 (Santa Barbara, USA). The nerves were washed for 3h continuously with Ringer's solution and action potentials were recorded. The nerve was then soaked overnight in Ringer's solution at room temperature and tested for impulse recovery. There were significant differences among the experiments regarding CNAP peak-to-peak amplitude, area and duration but conduction velocities among the experiments did not show any statistical difference.In the presence of bupivacaine the extracellular action potential amplitude decreased by 46.99+/-29.31% relative to the control amplitude ($P<0.05$), recovered to 47.10+/-26.90% after 3h of wash, and reached 123.20+/-39.70% after the overnight soak process.This study showed that exposing nerve to high concentration of bupivacaine causes reversible impulse blockade and that bupivacaine does not cause neurotoxic effect on isolated frog sciatic nerve.
Descriptors: frog, isolated sciatic nerve, conduction block, bupivacaine, high concentration, effects, spinal anesthesia, reversability, neurotoxic effect.

Crook, A.C. and H.H. Whiteman (2006). **An evaluation of ms-222 and benzocaine as anesthetics for metamorphic and paedomorphic tiger salamanders (*ambystoma tigrinum nebulosum*).** *American Midland Naturalist* 155(2): 417-421. ISSN: 0003-0031.
NAL Call Number: 410 M58

Descriptors: amphibians, anesthetics, tiger salamanders, ms-222, benzocaine, evaluation, induction, recovery time, dosages.

Green, S.L. (2003). **Postoperative analgesics in South African clawed frogs (*Xenopus laevis*) after surgical harvest of oocytes.** *Comparative Medicine* 53(3): 244-247. ISSN: 1532-0820.
NAL Call Number: SF77.C65
Descriptors: South African clawed frogs, *Xenopus laevis*, laboratory animals, pain, analgesia, animal welfare, narcotics, dosage, adrenergic agents.

Guenette, S.A., P. Helie, F. Beaudry, and P. Vachon (2007). **Eugenol for anesthesia of African clawed frogs (*Xenopus laevis*)**. *Veterinary Anaesthesia and Analgesia* 34(3): 164-170. ISSN: print: 1467-2987; online: 1467-2995.
Abstract: OBJECTIVE: To determine the level of anesthesia attained in *Xenopus laevis* frogs with eugenol at different doses and by different routes of administration. STUDY DESIGN: Prospective experimental trial. ANIMALS: Sixty *X. laevis* nonbreeding female frogs weighing between 90 and 140 g. METHODS: Three different routes of administration were tested - subcutaneous injections into the dorsal lymph sacs, topical administration using a gauze patch, and immersion in a bath containing eugenol. Following the determination of the best route of administration, the acetic acid test, the withdrawal reflex, righting reflex, heart rate, and respiratory frequency were used to evaluate central nervous system depression following eugenol bath administration. In an additional group, the response to a surgical incision of the abdominal wall was evaluated. The pharmacokinetics of eugenol were determined following bath immersion administration, and pharmacokinetic parameters were calculated following blood concentration determination by tandem liquid chromatography/mass spectrometry analyses. RESULTS: It was not possible to induce anethesia with subcutaneous and patch administration, independent of the eugenol dose administered. The immersion bath was the only efficacious route for anesthesia inducing surgical anesthesia for at least 30 minutes with postoperative analgesia. Histopathology of selected tissues (heart, lung, liver, kidneys, eyes) showed no evidence of lesions 24 hours following bath immersion. The elimination half-life (T(1/2)) was 4 hours. CONCLUSIONS: When administered as a single-bath immersion (dose 350 mg L(-1)) for 15 minutes, eugenol may serve as an effective anesthetic in *Xenopus laevis* frogs for short surgical procedures.
Descriptors: African clawed frogs, *Xenopus laevis*, amphibians, anesthesia, eugenol, doses, routes of administration, subcutaneous, topical, immersion bath, pharmacokinetics, blood concentration, surgical anesthesia.

Guenette, S.A. and S. Lair (2006). **Anesthesia of the leopard frog, *Rana pipiens*: a comparative study between four different agents**. *Journal of Herpetological Medicine and Surgery* 16(2): 38-44. ISSN: 1529-9651.
Online: http://www.arav.org/Journals/J053TI.htm
NAL Call Number: SF997.5.R4 B85
Descriptors: amphibians, leopard frog, *Rana pipiens*, anesthesia, anesthetics, benzocaine, drug combinations, lidocaine, pharmacodynamics, pharmacokinetics, pharmacology, comparative study, clove oil.

Guenette, S.A., D. Rodrigue, and P. Vachon (2005). **Utilisation des amphibiens en recherche: l'eugenol pour la gestion de la douleur chez la grenouille *Xenopus laevis*. [Utilization of amphibians in research: Eugenol in pain management in *Xenopus laevis*]**. *Medecin Veterinaire Du Quebec* 35(1): 12-14. ISSN: 0225-9591.
Descriptors: amphibians, frogs , *Xenopus laevis*, analgesics, eugenol, laboratory animals, pain management, research.
Language of Text: French.
Notes: Special issue: Medecine des animaux de laboratoire.

Kinkead, K.E., J.D. Lanham, and M.R. Montanucci (2006). **Comparison of anesthesia and marking techniques on stress and behavioral responses in two desmognathus salamanders**. *Journal of Herpetology* 40(3): 323-328. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: amphibians, salamanders, *Desmognathus fuscus*, *Desmognathus monticola*, dusky salamanders, seal salamanders, anesthesia, marking techniques, stress levels, behavioral responses, comparison, toe clipping, pain.

Kuffler, D.P., A. Lyfenko, L. Vyklicky, and V. Vlachova (2002). **Cellular mechanisms of nociception in the frog**. *Journal of Neurophysiology* 88(4): 1843-1850. ISSN: 0022-3077.
Descriptors: amphibians, frog, nociception, *Rana pipiens*, cellular mechanisms, defense reactions, neurons, temperature.

Martin, K.K. and C.W. Stevens (2003). **Nociceptin analgesia and receptor binding assay studies in amphibians.** *Society for Neuroscience Abstract Viewer and Itinerary Planner* 2003: Abstract No. 577.11. ISSN: 1529-2401.
Online: http://sfn.scholarone.com
Descriptors: amphibians, analgesia, nociception, receptor binding assay, nociceptin peptide, analgesia models, neuropeptide, meeting.
Notes: Meeting Information: 33rd Annual Meeting of the Society of Neuroscience, New Orleans, LA, USA; November 8-12, 2003.

Martin, K.K. and C.W. Stevens (2002). **Analgesia effects of nociceptin in amphibians.** 2002: Abstract No. 553.2. ISSN: 1529-2401.
Online: http://sfn.scholarone.com
Descriptors: amphibians, frog, *Rana pipiens*, nociceptin, analgesia effects, spinal administration, neuropeptide, nociceptive processing.
Notes: Meeting Information: 32nd Annual Meeting of the Society for Neuroscience, Orlando, Florida, USA; November 2-7, 2002.

Mohan, S. and C.W. Stevens (2006). **Systemic and spinal administration of the mu opioid, remifentanil, produces antinociception in amphibians.** *European Journal of Pharmacology* 534(1-3): 89-94. ISSN: 0014-2999.
Abstract: Remifentanil is a relatively new opioid analgesic related to the fentanyl family of mu opioid receptor agonists and is used clinically for its unique property of having an

ultra-short duration of action. However, there is little preclinical data on the analgesic (antinociceptive) effects of remifentanil and none obtained in non-mammalian animal models. The antinociceptive effects of remifentanil were assessed by using the acetic acid test in amphibians. Systemic and spinal administration of remifentanil was made by subcutaneous and intraspinal injections in the Northern grass frog, *Rana pipiens*. After administration, remifentanil produced dose-dependent and long-lasting antinociceptive effects which persisted for five hours after systemic administration but gave a shorter duration of action after spinal delivery. The antinociceptive effects of remifentanil were significantly blocked by pretreatment with systemic naltrexone. Systemic and spinal administration of remifentanil produced log dose-response curves which yielded ED50 values of 7.1 nmol/g and 3.2 nmol/animal respectively. The relative antinociceptive potency of remifentanil compared to other opioids administered to amphibians is similar to that found in mammalian models.
Descriptors: Northern grass frog, *Rana pipiens*, analgesics, opioid pharmacology, pain prevention and control, piperidines pharmacology, acetic acid, analgesics, opioid administration and dosage, dose response relationship, drug, injections, spinal, injections, subcutaneous, models, animal, naltrexone pharmacology, narcotic antagonists pharmacology, pain measurement, piperidines administration and dosage, receptors, opioid, mu drug effects, time factors.

Salio, C., E. Cottone, M. Conrath, and M.F. Franzoni (2002). **Cb1 cannabinoid receptors in amphibian spinal cord: relationships with some nociception markers**. *Journal of Chemical Neuroanatomy* 24(3): 153-162. ISSN: 0891-0618.
Descriptors: amphibians, spinal cord, cannabinoid receptors, Cb1, nociception markers, relationship, spinal analgesia, pain modulation.

Simon, M.P. and K.E. Mccarson (2002). **Nociceptive sensitivity of the frog *rana pipiens* to vanilloids.** In: *32nd Annual Meeting of the Society for Neuroscience, Society for Neuroscience Abstract Viewer and Itinerary Planner.,November 2, 2002-November 7, 2002, Orlando, Florida, USA,* Vol. 2002, p. Abstract No. 49.13.
Online: http://sfn.scholarone.com
Descriptors: amphibians, frog, *Rana pipiens*, nociceptive sensitivity, vanilloids, noxious stimuli, vertebrates, conference proceedings.

Stevens, C.W. (2004). **Opioid research in amphibians: an alternative pain model yielding insights on the evolution of opioid receptors.** *Brain Research. Brain Research Reviews* 46(2): 204-215. ISSN: 0165-0173.
Abstract: This review summarizes the work from our laboratory investigating mechanisms of opioid analgesia using the Northern grass frog, *Rana pipiens*. Over the last dozen years, we have accumulated data on the characterization of behavioral effects after opioid administration on radioligand binding by using opioid agonist and antagonist ligands in amphibian brain and spinal cord homogenates, and by cloning and sequencing opioid-like receptor cDNA from amphibian central nervous system (CNS) tissues. The relative analgesic potency of mu, delta, and kappa opioids is highly correlated between frogs and other mammals, including humans. Radioligand binding studies using selective opioid agonists show a similar selectivity profile in amphibians and mammals. In contrast, opioid antagonists that are highly

selective for mammalian mu, delta, and kappa opioid receptors were not selective in behavioral and binding studies in amphibians. Three opioid-like receptor cDNAs were cloned and sequenced from amphibian brain tissues and are orthologs to mammalian mu, delta, and kappa opioid receptors. Bioinformatics analysis of the three types of opioid receptor cDNAs from all vertebrate species with full datasets gave a pattern of the molecular evolution of opioid receptors marked by the divergence of mu, delta, and kappa opioid receptor sequences during vertebrate evolution. This divergence in receptor amino acid sequence in later-evolved vertebrates underlies the hypothesis that opioid receptors are more type-selective in mammals than in nonmammalian vertebrates. The apparent order of receptor type evolution is kappa, then delta, and, most recently, the mu opioid receptor. Finally, novel bioinformatics analyses suggest that conserved extracellular receptor domains determine the type selectivity of vertebrate opioid receptors.

Descriptors: amphibians, grass frog, *Rana pipiens*, pain models, opioid research, opioid receptors, evolution, opioid analgesia, mechanism, behavioral effects.

Stevens, C.W. and C.M. Brasel (2003). **Amphibian opioid receptors: cloning and sequence suggests pattern of opioid receptor evolution.** *Society for Neuroscience Abstract Viewer and Itinerary Planner* 2003: Abstract No. 577.10. ISSN: 0190-5295.

Online: http://sfn.scholarone.com

Descriptors: amphibians, opioid receptors, cloning, sequence, evolution, opioid analgesia, kappa receptors, delta receptors, mu, evolution.

Notes: Meeting Information: 33rd Annual Meeting of the Society of Neuroscience, New Orleans, LA, USA; November 8-12, 2003.

Stevens, C.W., G. Toth, A. Borsodi, and S. Benyhe (2007). **Xendorphin B1, a novel opioid-like peptide determined from a *Xenopus laevis* brain cDNA library, produces opioid antinociception after spinal administration in amphibians.** *Brain Research Bulletin* 71(6): 628-632. ISSN: 0361-9230.

Abstract: Prodynorphins (PDYNs) from the African clawed frog (*Xenopus laevis*), originally described as 'proxendorphins', are novel members of the family of opioid-like precursor polypeptides and were recently discovered based on polymerase chain reaction (PCR) isolates from a Xenopus brain cDNA library. This amphibian prodynorphin was found in two isoforms, (Xen)PDYN-A and (Xen)PDYN-B, consisting of 247 and 279 amino acids, respectively. Each prepropeptide contains five potential opioid-like peptides, collectively named xendorphins. One of these, xendorphin B1 ((Xen)PDYN-B sequence 96-111: YGGFIRK-PDKYKFLNA), is a hexadecapeptide that displaced [3H]naloxone and the radiolabelled kappa opioid, [3H]dynorphin A (1-17), with nanomolar affinity from rat brain membranes. Using the acetic acid pain test, the present study examined the antinociceptive effects of spinally administered xendorphin B1 in amphibians. Xendorphin B1 produced a long-lasting and dose-dependent antinociceptive effect in the Northern grass frog (*Rana pipiens*) with an ED50 value of 44.5 nmol/frog. The antinociceptive effects of xendorphin B1 were significantly blocked by pretreatment with the non-selective opioid antagonist, naltrexone. This is the first report of the in vivo characterization of a non-mammalian prodynorphin-derived peptide and suggests that xendorphin peptides may play a role in the modulation of noxious

information in vertebrates.
Descriptors: amphibians, African clawed frog, *Xenopus laevis*, Northern grass frog, *Rana pipiens*, xendorphin B1, opioid like peptide, brain, opioid antinociception, spinal administration, polymerase chain reaction.

Stevens, C.W. (2006). **Opioid analgesia research in amphibians: from behavioral assay to cloning opioid receptor genes.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 13: 9-15. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: amphibians, Northern grass frog, *Rana pipiens*, anesthesia , sedation, opioid analgesia, review of research.

Suwalsky, M., C. Schneider, B. Norris, F. Villena, H. Cardenas, F. Cuevas, and C.P. Sotomayor (2002). **The local anesthetic proparacaine modifies sodium transport in toad skin and perturbs the structures of model and cell membranes.** *Zeitschrift Fur Naturforschung. C, Journal of Biosciences* 57(9-10): 930-938. ISSN: 0939-5075.
NAL Call Number: QH301.Z4
Descriptors: amphibians, toad, local anesthetic, proparacaine, sodium transport, modifies, toad skin, pertubes structures, cell membranes.

Animal Models

Ariizumi, T., M. Kinoshita, C. Yokota, K. Takano, K. Fukuda, N. Moriyama, G.M. Malacinski, and M. Asashima (2003). **Amphibian in vitro heart induction: a simple and reliable model for the study of vertebrate cardiac development.** *International Journal of Developmental Biology* 47(6): 405-410. ISSN: 0214-6282.
Descriptors: amphibians, cardiac development, heart induction, in vitro, animal model, vertebrate, embryos, Xenopus, transplantation.

Beebee, T.J.C. (2005). **Conservation genetics of amphibians.** *Heredity* 95(6): 423-427. ISSN: 0018-067X.
Descriptors: amphibians, genetics research, conservation genetics.

Belzile, O., E. Simard, R. Gulemetova, A. Bairam, and R. Kinkead (2004). **Un modele amphibien pour l'etude du developpement du controle de la respiration. [Amphibians as a model system for the investigation of respiratory control development]**. *Medecine Sciences MS* 20(10): 904-908. ISSN: 0767-0974.
Abstract: Recent medical advances have made it possible for babies to survive premature birth at increasingly earlier developmental stages. This population requires costly and sophisticated medical care to address the problems associated with immaturity of the respiratory system. In addition to pulmonary complications, respiratory instability and apnea reflecting immaturity of the respiratory control system are major causes of hospitalization and morbidity in this highly vulnerable population. These medical concerns, combined with the curiosity of physiologists, have contributed to the expansion of research in respiratory neurobiology. While most researchers working in this field commonly use rodents as an animal model, recent research using in vitro brainstem preparation from bullfrogs (*Rana catesbeiana*) have revealed the technical advantages of this animal model, and shown that the basic principles underlying respiratory control and its ontogeny are very similar between these two groups of vertebrates. The present review highlights the recent advances in the area of research with a focus on intermittent (episodic) breathing and the role of serotonergic and GABAergic modulation of respiratory activity during development.
Descriptors: amphibians, bull frogs, animal model system, respiratory control system, episodicbreathing investigation, premature birth of human babies, immaturity, rodents.
Language of Text: French.

Burlibasa, L., N. Cucu, and L. Gavrila (2005). **Amphibians as model organisms for studying the dynamics of eukaryote genetic material architecture.** *Wildlife Biology in Practice* 1(1): 24-32. ISSN: print: 1646-1509; online: 1646-2742.
Online: http://dx.doi.org/10.2461/wbp.2005.1.4
Descriptors: amphibia, animal model, study of dynamics of eukaryote genetic architecture, review, cytogenetics.

Endepols, H., J. Schul, H.C. Gerhardt, and W. Walkowiak (2004). **6-hydroxydopamine lesions in anuran amphibians: a new model system for Parkinson's disease?** *Journal of Neurobiology* 60(4): 395-410. ISSN: 0022-3034.

NAL Call Number: QP351.J55

Abstract: We investigated the effects of dopamine depletion on acoustically guided behavior of anurans by conducting phonotaxis experiments with female gray treefrogs (*Hyla versicolor*) before and 90 min after bilateral injections of 3, 6, or 12 microg 6-hydroxydopamine (6-OHDA) into the telencephalic ventricles. In experiments with one loudspeaker playing back a standard artificial mating call, we analyzed the effects of 6-OHDA on phonotactic response time. In choice tests we measured the degree of distraction from the standard call (20 pulses/s) by three different variants with altered pulse-rate (30/s, 40/s, 60/s). Five days after experiments, brains were immunostained for tyrosine hydroxylase. Labeled neurons were counted in the suprachiasmatic nucleus, posterior tuberculum, interpeduncular nucleus, and locus coeruleus, and correlation between neuronal numbers and behavioral scores was tested. Response times increased together with 6-OHDA concentrations, which was mainly due to longer immobile periods before the animals started movement. In choice tests the most irrelevant stimulus (60/s) distracted 6-OHDA injected females from the standard stimulus, while sham injected controls were undistracted. The number of catecholaminergic neurons decreased with increasing 6-OHDA concentration in the suprachiasmatic nucleus, posterior tuberculum, and interpeduncular nucleus. The normalized number of immunoreactive neurons in the posterior tuberculum was positively correlated with phonotaxis scores in the one-speaker test, demonstrating that motor deficits are a function of tubercular cell loss. We conclude that bilateral 6-OHDA lesions in anuran amphibians cause motor (difficulty to start movements) as well as cognitive symptoms (higher distraction by irrelevant stimuli) that have also been described for human Parkinson patients.

Descriptors: anuran amphibians, gray tree frogs, new animal research model system, Parkinson's disease, 6 hydroxy dopamine lesions.

Gantress, J., G.D. Maniero, N. Cohen, and J. Robert (2003). **Development and characterization of a model system to study amphibian immune responses to iridoviruses.** *Virology* 311(2): 254-262. ISSN: 0042-6822.

Descriptors: amphibians, *Xenopus laevis*, model system development, immune responses, iridoviruses.

Gross, M.L., W. Hanke, A. Koch, H. Ziebart, K. Amann, and E. Ritz (2002). **Intraperitoneal protein injection in the axolotl: the amphibian kidney as a novel model to study tubulointerstitial activation**. *Kidney International* 62(1): 51-59. ISSN: 0085-2538.

Descriptors: amphibians, kidney, novel model, tubulointerstitial activation, urinary system, axolotl, intraperitoneal protein injection.

Hudson, N.J. and C.E. Franklin (2002). **Maintaining muscle mass during extended disuse: aestivating frogs as a model species.** *Journal of Experimental Biology* 205(15): 2297-2303. ISSN: 0022-0949.

NAL Call Number: 442.8 B77

Descriptors: estivating frogs, model species, muscle mass, maintaining, literature review, dormancy, muscle maintenance, musculature, muscle maintenance during extended disuse, review.

Kloas, W. (2002). **Amphibians as a model for the study of endocrine disruptors.** In: K.W. Jeon (Editor), *International Review of Cytology: A Survey of Cell Biology,* Vol. 216, p. 1-57. ISBN: 978-0-12-364620-0.
Online: http://dx.doi.org/10.1016/S0074-7696(02)16002-5
Descriptors: amphibians, endocrine disrupters, study model, book chapter.

Kloas, W. and I. Lutz (2006). **Amphibians as model to study endocrine disrupters**. *Journal of Chromatography A* 1130(1, Sp. Iss. SI): 16-27. ISSN: 0021-9673.
Descriptors: amphibians, animal model, endocrine disrupters, pharmacology, endocrine system, reproductive system, bioassay, thyroid system.

Morse, R.P. and E.F. Evans (2003). **The sciatic nerve of the toad *Xenopus laevis* as a physiological model of the human cochlear nerve.** *Hearing Research* 182(1-2): 97-118. ISSN: 0378-5955.
Descriptors: amphibians, toad, *Xenopus laevis*, sciatic nerve, physiological research animal model, human cochlear nerve.

Naitoh, T., M. Yamashita, and R.J. Wassersug (2004). **Life history of amphibians and gravity.** *Uchu Seibutsu Kagaku* 18(3): 130-131. ISSN: 0914-9201.
Abstract: Anurans hold a unique position in vertebrate phylogeny, as they made the major transition from water to land. Through evolution they have acquired fundamental mechanisms to adapt to terrestrial gravity. Such mechanisms are now shared among other terrestrial vertebrates derived from ancestral amphibians. Space research, using amphibians as a model animal, is significant based on the following aspects: (1) Anuran amphibians show drastic changes in their living niche during their metamorphosis. Environments for tadpoles and for terrestrial life of frogs are quite different in terms of gravity and its associated factors. (2) Certain tadpoles, such as *Rhacophorus viridis amamiensis*, have a transparent abdominal wall. Thus visceral organs and their motion can be observed in these animals in non-invasive manner through their transparent abdominal skin. This feature enables biologists to evaluate the physiological state of these amphibians and study the autonomic control of visceral organs. It is also feasible for space biologists to examine how such autonomic regulation could be altered by microgravity and exposure to the space environment.
Descriptors: amphibians, physiology, anura physiology, developmental biology, gastrointestinal tract physiology, amphibia classification, amphibia growth, development , anura, classification, anura growth, development, evolution, larva growth, development, larva physiology, animal models, space flight, weightlessness.

Peinado, J.R., J.P. Castano, R. Vazquez Martinez , Y. Anouar, M.C. Tonon, H. Vaudry, F. Gracia Navarro, and M.M. Malagon (2002). **Amphibian melanotrophs as a model to analyze the secretory plasticity of endocrine cells.** *General and Comparative Endocrinology* 126(1): 4-6. ISSN: 0016-6480.

NAL Call Number: 444.8 G28
Descriptors: amphibians, pituitary gland, intermediate lobe melanotrophs, secretory plasiticity models, review.

Pierantoni, R., G. Cobellis, R. Meccariello, C. Palmiero, G. Fienga, S. Minucci, and S. Fasano (2002). **The amphibian testis as model to study germ cell progression during spermatogenesis.** *Comparative Biochemistry and Physiology Part B Biochemistry and Molecular Biology* 132(1): 131-139. ISSN: 1096-4959.
Abstract: Testicular morphology of vertebrate testis indicates requirement of local control. In urodeles, the testis is organized in lobes of increasing maturity throughout the cephalocaudal axis. The anuran testis is organized in tubules. Spermatogenesis occurs in cysts composed by Sertoli cells enveloping germ cells at synchronous stages. Moreover, in numerous species germ cell progression lasts a year which defines the sexual cycle. Due to the above quoted features, research on factors regulating germ cell progression in amphibians may reach greater insight as compared with mammalian animal models. In particular, studies on endocrine and paracrine/autocrine factors involved in the regulation of germ cell functions reveal that fos activation and a J protein, previously specifically found in mouse testis, exert an important role in spermatogonial proliferation and maturation of post-meiotic stages, respectively.
Descriptors: amphibian, testis, germ cell progression, spermatogenesis, testicular morphology, vertebrate testis.

Rollins Smith, L.A., B.D. Hopkins, and L.K. Reinert (2004). **An amphibian model to test the effects of xenobiotic chemicals on development of the hematopoietic system.** *Environmental Toxicology and Chemistry* 23(12): 2863-2867. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Abstract: A number of manmade chemicals have deleterious effects on the developing immune system. Very few assay systems are available to study the effects of xenobiotics on hematopoietic stem cells. In rodent models, assays require exposure of pregnant females and analysis of the hematopoietic potential of stem cells from the offspring. These models are less relevant to lower vertebrates such as fish or amphibians where exposure of embryos is direct. To overcome this problem, an amphibian model was developed. Diploid (2N) embryos (16-20 h of age) of the South African clawed frog, *Xenopus laevis*, were exposed to 10 microg/ml diazinon or 10(-6) M lead acetate for 2 h. After 2 h, the ventral blood island (VBI) was transplanted from a chemically treated or untreated control embryo to an untreated triploid (3N) host embryo. After 55 d, the contribution of the donor VBI-derived stem cells to populations in the blood, thymus, and spleen was assessed by flow cytometry. Diazinon, but not lead acetate, interfered with the ability of transplanted stem cells to contribute to hematopoiesis. Because amphibian embryos are very sensitive indicators of the toxic effects of chemicals, this VBI assay could be employed to test any toxic chemical that is suspected of having a negative effect on development of the hematopoietic system.
Descriptors: amphibians, frog, *Xenopus laevis*, animal model, xenobiotic chemicals, effects, test, hematopoetic system, development, immune system, assay systems.

Ryffel, G.U. (2003). **What can a frog tell us about human kidney development.** *Nephron* 94(2): e35-e43. ISSN: 0028-2766.
Descriptors: amphibians, frog, kidney development, nephrogenesis, vertrbrates, human kidney development, renal diseases.

Schnizler, M., A. Berk, M. Fronius, and W.G. Clauss (2002). **The amphibian lung provides a physiologically intact model for investigation of alveolar ion transport regulation**. *Pfluegers Archiv European Journal of Physiology* 443(Suppl. 1): S386. ISSN: 0031-6768.
Descriptors: amphibian, lung, physiologicall intact model, alveolar ion transport, regulation, respiratory system.

Straka, H., R. Baker, and E. Gilland (2002). **The frog as a unique vertebrate model for studying the rhombomeric organization of functionally identified hindbrain neurons**. *Brain Research Bulletin* 57(3-4): 301-305. ISSN: 0361-9230.
Descriptors: frog, vertebrate model, hindbrain neurons, rhombomeric organization, studying , cranial nerve, precerebral neurons.

Tata, J.R. (2006). **Amphibian metamorphosis as a model for the developmental actions of thyroid hormone.** *Molecular and Cellular Endocrinology* 246(1-2): 10-20. ISSN: 0303-7207.
Abstract: Thyroid hormone (TH) elicits multiple physiological actions in vertebrates from fish to man. These actions can be divided into two broad categories: those where the hormone regulates developmental processes and those that involve actions in the adult organism. Amphibian metamorphosis is a most dramatic example of extensive morphological, biochemical and cellular changes occurring during post-embryonic development, which is obligatorily initiated and sustained by TH. It is, therefore, an ideal model system to understand the action of the hormone. Each tissue of the frog tadpole responds differently to TH, ranging from altered gene expression, morphogenesis, tissue re-structuring and extensive cell death, according to a developmental programme set in place before the thyroid gland begins to secrete the hormone. The key element determining the response to the hormone is the nuclear thyroid hormone receptor (TR). As in most vertebrates, there are two thyroid hormone receptors, TRalpha and TRbeta, which repress transcription in the absence of the ligand and whose concentration in the tissues is directly modulated by the hormone itself. In Xenopus, biochemical and in situ techniques have shown that the amount of TRbeta mRNA and protein are elevated 50-100 times during TH-induced metamorphic climax. This phenomenon of "autoinduction" of receptor is also seen with developmental or inductive processes regulated by other hormones acting through nuclear receptors. It is possible that receptor upregulation may be a pre-requisite for hormonal response. Recent molecular and cell biological studies have suggested that TRs function as multimeric complexes with other nuclear or chromatin proteins, such as co-repressors and co-activators, to regulate the structure of the chromatin, and thereby determine the transcription of the receptor-specified target gene. There is evidence that this may also be so for thyroid hormone regulated transcription during amphibian metamorphosis.
Descriptors: amphibia growth and development, metamorphosis biological, models biologi-

cal, thyroid hormones physiology, apoptosis, receptors, thyroid hormone genetics, receptors, thyroid hormone physiology.

Yoshii, C., Y. Ueda, M. Okamoto, and M. Araki (2007). **Neural retinal regeneration in the anuran amphibian *Xenopus laevis* post-metamorphosis: transdifferentiation of retinal pigmented epithelium regenerates the neural retina.** *Developmental Biology* 303(1): 45-56. ISSN: 0012-1606.

Abstract: In urodele amphibians like the newt, complete retina and lens regeneration occurs throughout their lives. In contrast, anuran amphibians retain this capacity only in the larval stage and quickly lose it during metamorphosis. It is believed that they are unable to regenerate these tissues after metamorphosis. However, contrary to this generally accepted notion, here we report that both the neural retina (NR) and lens regenerate following the surgical removal of these tissues in the anuran amphibian, *Xenopus laevis*, even in the mature animal. The NR regenerated both from the retinal pigment epithelial (RPE) cells by transdifferentiation and from the stem cells in the ciliary marginal zone (CMZ) by differentiation. In the early stage of NR regeneration (5-10 days post operation), RPE cells appeared to delaminate from the RPE layer and adhere to the remaining retinal vascular membrane. Thereafter, they underwent transdifferentiation to regenerate the NR layer. An in vitro culture study also revealed that RPE cells differentiated into neurons and that this was accelerated by the presence of FGF-2 and IGF-1. The source of the regenerating lens appeared to be remaining lens epithelium, suggesting that this is a kind of repair process rather than regeneration. Thus, we show for the first time that anuran amphibians retain the capacity for retinal regeneration after metamorphosis, similarly to urodeles, but that the mode of regeneration differs between the two orders. Our study provides a new tool for the molecular analysis of regulatory mechanisms involved in retinal and lens regeneration by providing an alternative animal model to the newt, the only other experimental model.

Descriptors: amphibians, *Xenopus laevis*, neural retinal regeneration, newt, metamorphosis, retina, lens, animal model.

Zayas, J.G., D.W. O'Brien, S. Tai, J. Ding, L. Lim, and M. King (2004). **Adaptation of an amphibian mucociliary clearance model to evaluate early effects of tobacco smoke exposure.** *Respiratory Research* 5: 9. ISSN: 1465-9921.

Abstract: RATIONALE: Inhaled side-stream tobacco smoke brings in all of its harmful components impairing mechanisms that protect the airways and lungs. Chronic respiratory health consequences are a complex multi-step silent process. By the time clinical manifestations require medical attention, several structural and functional changes have already occurred. The respiratory system has to undergo an iterative process of injury, healing and remodeling with every exposure. METHODS: To have a better understanding of the initial changes that take place when first exposed to environmental tobacco smoke, we have developed an exposure model, using the frog palate that closely represents the features of obstructive airways where ciliary dysfunction and mucus hypersecretion occur. RESULTS: Mucus transport was significantly reduced, even after exposure to the smoke of one cigarette ($p < 0.05$) and even further with 4-cigarettes exposure ($p < 0.001$). Morphometric and ultrastructural studies by SEM show extensive areas of tissue disruption. Gelatinase zymography

shows activation of MMP9 in mucus from palates exposed to tobacco smoke. CONCLUSIONS: The clearance of mucus on the frog palate is significantly reduced after exposure to environmental tobacco smoke. Cilia and the extracellular matrix are anatomically disrupted. Tobacco smoke triggers an increased activity of matrix metalloproteinases associated with a substantial defoliation of ciliated epithelium. These studies enhance the knowledge of the changes in the mucociliary apparatus that occur initially after exposure to environmental tobacco smoke, with the goal of understanding how these changes relate to the genesis of chronic airway pathologies in humans.

Descriptors: amphibians, frog, *Rana catesbeiana*, environmental exposure adverse effects, tobacco smoke exposure, animal models, mucociliary clearance, palate pathology, anatomy, histology, palate drug effects.

Anoxia and Hypoxia

Ariizumi, T., M. Kinoshita, C. Yokota, K. Takano, K. Fukuda, N. Moriyama, G.M. Malacinski, and M. Asashima (2003). **Amphibian in vitro heart induction: a simple and reliable model for the study of vertebrate cardiac development.** *International Journal of Developmental Biology* 47(6): 405-410. ISSN: 0214-6282.
Descriptors: amphibians, cardiac development, heart induction, in vitro, animal model, vertebrate, embryos, Xenopus, transplantation.

Beebee, T.J.C. (2005). **Conservation genetics of amphibians.** *Heredity* 95(6): 423-427. ISSN: 0018-067X.
Descriptors: amphibians, genetics research, conservation genetics.

Belzile, O., E. Simard, R. Gulemetova, A. Bairam, and R. Kinkead (2004). **Un modele amphibien pour l'etude du developpement du controle de la respiration. [Amphibians as a model system for the investigation of respiratory control development]**. *Medecine Sciences MS* 20(10): 904-908. ISSN: 0767-0974.
Abstract: Recent medical advances have made it possible for babies to survive premature birth at increasingly earlier developmental stages. This population requires costly and sophisticated medical care to address the problems associated with immaturity of the respiratory system. In addition to pulmonary complications, respiratory instability and apnea reflecting immaturity of the respiratory control system are major causes of hospitalization and morbidity in this highly vulnerable population. These medical concerns, combined with the curiosity of physiologists, have contributed to the expansion of research in respiratory neurobiology. While most researchers working in this field commonly use rodents as an animal model, recent research using in vitro brainstem preparation from bullfrogs (*Rana catesbeiana*) have revealed the technical advantages of this animal model, and shown that the basic principles underlying respiratory control and its ontogeny are very similar between these two groups of vertebrates. The present review highlights the recent advances in the area of research with a focus on intermittent (episodic) breathing and the role of serotonergic and GABAergic modulation of respiratory activity during development.
Descriptors: amphibians, bull frogs, animal model system, respiratory control system, episodicbreathing investigation, premature birth of human babies, immaturity, rodents.
Language of Text: French.

Burlibasa, L., N. Cucu, and L. Gavrila (2005). **Amphibians as model organisms for studying the dynamics of eukaryote genetic material architecture.** *Wildlife Biology in Practice* 1(1): 24-32. ISSN: print: 1646-1509; online: 1646-2742.
Online: http://dx.doi.org/10.2461/wbp.2005.1.4
Descriptors: amphibia, animal model, study of dynamics of eukaryote genetic architecture, review, cytogenetics.

Endepols, H., J. Schul, H.C. Gerhardt, and W. Walkowiak (2004). **6-hydroxydopamine lesions in anuran amphibians: a new model system for Parkinson's disease?** *Journal of Neurobiology* 60(4): 395-410. ISSN: 0022-3034.
NAL Call Number: QP351.J55
Abstract: We investigated the effects of dopamine depletion on acoustically guided behavior of anurans by conducting phonotaxis experiments with female gray treefrogs (*Hyla versicolor*) before and 90 min after bilateral injections of 3, 6, or 12 microg 6-hydroxydopamine (6-OHDA) into the telencephalic ventricles. In experiments with one loudspeaker playing back a standard artificial mating call, we analyzed the effects of 6-OHDA on phonotactic response time. In choice tests we measured the degree of distraction from the standard call (20 pulses/s) by three different variants with altered pulse-rate (30/s, 40/s, 60/s). Five days after experiments, brains were immunostained for tyrosine hydroxylase. Labeled neurons were counted in the suprachiasmatic nucleus, posterior tuberculum, interpeduncular nucleus, and locus coeruleus, and correlation between neuronal numbers and behavioral scores was tested. Response times increased together with 6-OHDA concentrations, which was mainly due to longer immobile periods before the animals started movement. In choice tests the most irrelevant stimulus (60/s) distracted 6-OHDA injected females from the standard stimulus, while sham injected controls were undistracted. The number of catecholaminergic neurons decreased with increasing 6-OHDA concentration in the suprachiasmatic nucleus, posterior tuberculum, and interpeduncular nucleus. The normalized number of immunoreactive neurons in the posterior tuberculum was positively correlated with phonotaxis scores in the one-speaker test, demonstrating that motor deficits are a function of tubercular cell loss. We conclude that bilateral 6-OHDA lesions in anuran amphibians cause motor (difficulty to start movements) as well as cognitive symptoms (higher distraction by irrelevant stimuli) that have also been described for human Parkinson patients.
Descriptors: anuran amphibians, gray tree frogs, new animal research model system, Parkinson's disease, 6 hydroxy dopamine lesions.

Gantress, J., G.D. Maniero, N. Cohen, and J. Robert (2003). **Development and characterization of a model system to study amphibian immune responses to iridoviruses.** *Virology* 311(2): 254-262. ISSN: 0042-6822.
Descriptors: amphibians, *Xenopus laevis*, model system development, immune responses, iridoviruses.

Gross, M.L., W. Hanke, A. Koch, H. Ziebart, K. Amann, and E. Ritz (2002). **Intraperitoneal protein injection in the axolotl: the amphibian kidney as a novel model to study tubulointerstitial activation**. *Kidney International* 62(1): 51-59. ISSN: 0085-2538.
Descriptors: amphibians, kidney, novel model, tubulointerstitial activation, urinary system, axolotl, intraperitoneal protein injection.

Hudson, N.J. and C.E. Franklin (2002). **Maintaining muscle mass during extended disuse: aestivating frogs as a model species.** *Journal of Experimental Biology* 205(15): 2297-2303. ISSN: 0022-0949.
NAL Call Number: 442.8 B77

Descriptors: estivating frogs, model species, muscle mass, maintaining, literature review, dormancy, muscle maintenance, musculature, muscle maintenance during extended disuse, review.

Kloas, W. (2002). **Amphibians as a model for the study of endocrine disruptors.** In: K.W. Jeon (Editor), *International Review of Cytology: A Survey of Cell Biology,* Vol. 216, p. 1-57. ISBN: 978-0-12-364620-0.
Online: http://dx.doi.org/10.1016/S0074-7696(02)16002-5
Descriptors: amphibians, endocrine disrupters, study model, book chapter.

Kloas, W. and I. Lutz (2006). **Amphibians as model to study endocrine disrupters**. *Journal of Chromatography A* 1130(1, Sp. Iss. SI): 16-27. ISSN: 0021-9673.
Descriptors: amphibians, animal model, endocrine disrupters, pharmacology, endocrine system, reproductive system, bioassay, thyroid system.

Morse, R.P. and E.F. Evans (2003). **The sciatic nerve of the toad *Xenopus laevis* as a physiological model of the human cochlear nerve.** *Hearing Research* 182(1-2): 97-118. ISSN: 0378-5955.
Descriptors: amphibians, toad, *Xenopus laevis*, sciatic nerve, physiological research animal model, human cochlear nerve.

Naitoh, T., M. Yamashita, and R.J. Wassersug (2004). **Life history of amphibians and gravity.** *Uchu Seibutsu Kagaku* 18(3): 130-131. ISSN: 0914-9201.
Abstract: Anurans hold a unique position in vertebrate phylogeny, as they made the major transition from water to land. Through evolution they have acquired fundamental mechanisms to adapt to terrestrial gravity. Such mechanisms are now shared among other terrestrial vertebrates derived from ancestral amphibians. Space research, using amphibians as a model animal, is significant based on the following aspects: (1) Anuran amphibians show drastic changes in their living niche during their metamorphosis. Environments for tadpoles and for terrestrial life of frogs are quite different in terms of gravity and its associated factors. (2) Certain tadpoles, such as *Rhacophorus viridis amamiensis*, have a transparent abdominal wall. Thus visceral organs and their motion can be observed in these animals in non-invasive manner through their transparent abdominal skin. This feature enables biologists to evaluate the physiological state of these amphibians and study the autonomic control of visceral organs. It is also feasible for space biologists to examine how such autonomic regulation could be altered by microgravity and exposure to the space environment.
Descriptors: amphibians, physiology, anura physiology, developmental biology, gastrointestinal tract physiology, amphibia classification, amphibia growth, development , anura, classification, anura growth, development, evolution, larva growth, development, larva physiology, animal models, space flight, weightlessness.

Peinado, J.R., J.P. Castano, R. Vazquez Martinez , Y. Anouar, M.C. Tonon, H. Vaudry, F. Gracia Navarro, and M.M. Malagon (2002). **Amphibian melanotrophs as a model to analyze the secretory plasticity of endocrine cells.** *General and Comparative Endocrinology* 126(1): 4-6. ISSN: 0016-6480.

NAL Call Number: 444.8 G28
Descriptors: amphibians, pituitary gland, intermediate lobe melanotrophs, secretory plasiticity models, review.

Pierantoni, R., G. Cobellis, R. Meccariello, C. Palmiero, G. Fienga, S. Minucci, and S. Fasano (2002). **The amphibian testis as model to study germ cell progression during spermatogenesis.** *Comparative Biochemistry and Physiology Part B Biochemistry and Molecular Biology* 132(1): 131-139. ISSN: 1096-4959.
Abstract: Testicular morphology of vertebrate testis indicates requirement of local control. In urodeles, the testis is organized in lobes of increasing maturity throughout the cephalocaudal axis. The anuran testis is organized in tubules. Spermatogenesis occurs in cysts composed by Sertoli cells enveloping germ cells at synchronous stages. Moreover, in numerous species germ cell progression lasts a year which defines the sexual cycle. Due to the above quoted features, research on factors regulating germ cell progression in amphibians may reach greater insight as compared with mammalian animal models. In particular, studies on endocrine and paracrine/autocrine factors involved in the regulation of germ cell functions reveal that fos activation and a J protein, previously specifically found in mouse testis, exert an important role in spermatogonial proliferation and maturation of post-meiotic stages, respectively.
Descriptors: amphibian, testis, germ cell progression, spermatogenesis, testicular morphology, vertebrate testis.

Rollins Smith, L.A., B.D. Hopkins, and L.K. Reinert (2004). **An amphibian model to test the effects of xenobiotic chemicals on development of the hematopoietic system.** *Environmental Toxicology and Chemistry* 23(12): 2863-2867. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Abstract: A number of manmade chemicals have deleterious effects on the developing immune system. Very few assay systems are available to study the effects of xenobiotics on hematopoietic stem cells. In rodent models, assays require exposure of pregnant females and analysis of the hematopoietic potential of stem cells from the offspring. These models are less relevant to lower vertebrates such as fish or amphibians where exposure of embryos is direct. To overcome this problem, an amphibian model was developed. Diploid (2N) embryos (16-20 h of age) of the South African clawed frog, *Xenopus laevis*, were exposed to 10 microg/ml diazinon or 10(-6) M lead acetate for 2 h. After 2 h, the ventral blood island (VBI) was transplanted from a chemically treated or untreated control embryo to an untreated triploid (3N) host embryo. After 55 d, the contribution of the donor VBI-derived stem cells to populations in the blood, thymus, and spleen was assessed by flow cytometry. Diazinon, but not lead acetate, interfered with the ability of transplanted stem cells to contribute to hematopoiesis. Because amphibian embryos are very sensitive indicators of the toxic effects of chemicals, this VBI assay could be employed to test any toxic chemical that is suspected of having a negative effect on development of the hematopoietic system.
Descriptors: amphibians, frog, *Xenopus laevis*, animal model, xenobiotic chemicals, effects, test, hematopoetic system, development, immune system, assay systems.

Ryffel, G.U. (2003). **What can a frog tell us about human kidney development.** *Nephron* 94(2): e35-e43. ISSN: 0028-2766.
Descriptors: amphibians, frog, kidney development, nephrogenesis, vertrbrates, human kidney development, renal diseases.

Schnizler, M., A. Berk, M. Fronius, and W.G. Clauss (2002). **The amphibian lung provides a physiologically intact model for investigation of alveolar ion transport regulation**. *Pfluegers Archiv European Journal of Physiology* 443(Suppl. 1): S386. ISSN: 0031-6768.
Descriptors: amphibian, lung, physiologicall intact model, alveolar ion transport, regulation, respiratory system.

Straka, H., R. Baker, and E. Gilland (2002). **The frog as a unique vertebrate model for studying the rhombomeric organization of functionally identified hindbrain neurons**. *Brain Research Bulletin* 57(3-4): 301-305. ISSN: 0361-9230.
Descriptors: frog, vertebrate model, hindbrain neurons, rhombomeric organization, studying , cranial nerve, precerebral neurons.

Tata, J.R. (2006). **Amphibian metamorphosis as a model for the developmental actions of thyroid hormone.** *Molecular and Cellular Endocrinology* 246(1-2): 10-20. ISSN: 0303-7207.
Abstract: Thyroid hormone (TH) elicits multiple physiological actions in vertebrates from fish to man. These actions can be divided into two broad categories: those where the hormone regulates developmental processes and those that involve actions in the adult organism. Amphibian metamorphosis is a most dramatic example of extensive morphological, biochemical and cellular changes occurring during post-embryonic development, which is obligatorily initiated and sustained by TH. It is, therefore, an ideal model system to understand the action of the hormone. Each tissue of the frog tadpole responds differently to TH, ranging from altered gene expression, morphogenesis, tissue re-structuring and extensive cell death, according to a developmental programme set in place before the thyroid gland begins to secrete the hormone. The key element determining the response to the hormone is the nuclear thyroid hormone receptor (TR). As in most vertebrates, there are two thyroid hormone receptors, TRalpha and TRbeta, which repress transcription in the absence of the ligand and whose concentration in the tissues is directly modulated by the hormone itself. In Xenopus, biochemical and in situ techniques have shown that the amount of TRbeta mRNA and protein are elevated 50-100 times during TH-induced metamorphic climax. This phenomenon of "autoinduction" of receptor is also seen with developmental or inductive processes regulated by other hormones acting through nuclear receptors. It is possible that receptor upregulation may be a pre-requisite for hormonal response. Recent molecular and cell biological studies have suggested that TRs function as multimeric complexes with other nuclear or chromatin proteins, such as co-repressors and co-activators, to regulate the structure of the chromatin, and thereby determine the transcription of the receptor-specified target gene. There is evidence that this may also be so for thyroid hormone regulated transcription during amphibian metamorphosis.
Descriptors: amphibia growth and development, metamorphosis biological, models biologi-

cal, thyroid hormones physiology, apoptosis, receptors, thyroid hormone genetics, receptors, thyroid hormone physiology.

Yoshii, C., Y. Ueda, M. Okamoto, and M. Araki (2007). **Neural retinal regeneration in the anuran amphibian *Xenopus laevis* post-metamorphosis: transdifferentiation of retinal pigmented epithelium regenerates the neural retina.** *Developmental Biology* 303(1): 45-56. ISSN: 0012-1606.

Abstract: In urodele amphibians like the newt, complete retina and lens regeneration occurs throughout their lives. In contrast, anuran amphibians retain this capacity only in the larval stage and quickly lose it during metamorphosis. It is believed that they are unable to regenerate these tissues after metamorphosis. However, contrary to this generally accepted notion, here we report that both the neural retina (NR) and lens regenerate following the surgical removal of these tissues in the anuran amphibian, *Xenopus laevis*, even in the mature animal. The NR regenerated both from the retinal pigment epithelial (RPE) cells by transdifferentiation and from the stem cells in the ciliary marginal zone (CMZ) by differentiation. In the early stage of NR regeneration (5-10 days post operation), RPE cells appeared to delaminate from the RPE layer and adhere to the remaining retinal vascular membrane. Thereafter, they underwent transdifferentiation to regenerate the NR layer. An in vitro culture study also revealed that RPE cells differentiated into neurons and that this was accelerated by the presence of FGF-2 and IGF-1. The source of the regenerating lens appeared to be remaining lens epithelium, suggesting that this is a kind of repair process rather than regeneration. Thus, we show for the first time that anuran amphibians retain the capacity for retinal regeneration after metamorphosis, similarly to urodeles, but that the mode of regeneration differs between the two orders. Our study provides a new tool for the molecular analysis of regulatory mechanisms involved in retinal and lens regeneration by providing an alternative animal model to the newt, the only other experimental model.

Descriptors: amphibians, *Xenopus laevis*, neural retinal regeneration, newt, metamorphosis, retina, lens, animal model.

Zayas, J.G., D.W. O'Brien, S. Tai, J. Ding, L. Lim, and M. King (2004). **Adaptation of an amphibian mucociliary clearance model to evaluate early effects of tobacco smoke exposure.** *Respiratory Research* 5: 9. ISSN: 1465-9921.

Abstract: RATIONALE: Inhaled side-stream tobacco smoke brings in all of its harmful components impairing mechanisms that protect the airways and lungs. Chronic respiratory health consequences are a complex multi-step silent process. By the time clinical manifestations require medical attention, several structural and functional changes have already occurred. The respiratory system has to undergo an iterative process of injury, healing and remodeling with every exposure. METHODS: To have a better understanding of the initial changes that take place when first exposed to environmental tobacco smoke, we have developed an exposure model, using the frog palate that closely represents the features of obstructive airways where ciliary dysfunction and mucus hypersecretion occur. RESULTS: Mucus transport was significantly reduced, even after exposure to the smoke of one cigarette ($p < 0.05$) and even further with 4-cigarettes exposure ($p < 0.001$). Morphometric and ultrastructural studies by SEM show extensive areas of tissue disruption. Gelatinase zymography

shows activation of MMP9 in mucus from palates exposed to tobacco smoke. CONCLUSIONS: The clearance of mucus on the frog palate is significantly reduced after exposure to environmental tobacco smoke. Cilia and the extracellular matrix are anatomically disrupted. Tobacco smoke triggers an increased activity of matrix metalloproteinases associated with a substantial defoliation of ciliated epithelium. These studies enhance the knowledge of the changes in the mucociliary apparatus that occur initially after exposure to environmental tobacco smoke, with the goal of understanding how these changes relate to the genesis of chronic airway pathologies in humans.

Descriptors: amphibians, frog, *Rana catesbeiana*, environmental exposure adverse effects, tobacco smoke exposure, animal models, mucociliary clearance, palate pathology, anatomy, histology, palate drug effects.

Behavior

Abrunhosa, P.A. and H. Wogel (2004). **Breeding behavior of the leaf-frog *Phyllomedusa burmeisteri* (Anura: Hylidae).** *Amphibia Reptilia* 25(2): 125-135. ISSN: 0173-5373.
Descriptors: leaf frog, *Phyllomedusa burmeisteri*, breeding behavior, males.

Coddington, E. and F.L. Moore (2003). **Neuroendocrinology of context-dependent stress responses: vasotocin alters the effect of corticosterone on amphibian behaviors.** *Hormones and Behavior* 43(1): 222-228. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Descriptors: amphibian, stress responses, neuroendocrinology, vasotocin alters effect of corticosterone, behavior.

Gordon, N.M. (2004). **The effect of supplemental feeding on the territorial behavior of the green frog (*Rana clamitans*).** *Amphibia Reptilia* 25(1): 55-62. ISSN: 0173-5373.
Descriptors: *Rana clamitans*, green frog, supplemental feeding, effect, ter ritorial behavior.

Hobel, G. (2005). ***Rana palustris* (pickerel frog) and *Ambystoma maculatum* (spotted salamander). Reproductive behavior.** *Herpetological Review* 36(1): 55-56. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: pickerel frog , *Rana palustris*, spotted salamander, *Ambystoma maculatum*, reproductive behavior.

Hosie, C. and N. Hind (2004). **Using behaviour to assess welfare in captive amphibians.** *Animal Welfare* 13(Suppl.): S244. ISSN: 0962-7286.
NAL Call Number: HV4701.A557
Descriptors: amphibians, captive, welfare, behavior, assess, meeting, UFAW.
Notes: Meeting Information: Universities Federation for Animal Welfare (UFAW) Symposium on Science in the Service of Animal Welfare, Edinburgh, UK; April 2-4, 2003.

Jofre, G.M., C.J. Reading, and I.E. di Tada (2005). **Breeding behaviour and reproduction in the Pampa de Achala toad, *Bufo achalensis*.** *Amphibia Reptilia* 26(4): 451-458. ISSN: 0173-5373.
Descriptors: toad, *Bufo achalensis*, reproduction, breeding behavior.

Kunz, K. (2004). **Zum Paarungsverhalten Tropischer Krallenfroesche *Silurana* sp. Tiel 2. [The pairing behavior of the tropical clawed frogs *Silurana* sp. Part 2.]**. *Reptilia D* 9(1): 56-62 Nr 45. ISSN: 1431-8997.
Descriptors: tropical clawed frog, *Silurana* species, pairing behavior, mating, reproduction.
Language of Text: German.

Martinez Solano, I. and M. Garcia Paris (2004). **Comportamientos defensivos de ranas y sapos. [Defensive behavior of frogs and toads.]**. *Quercus* 225: 32-35. ISSN: 0212-0054.
Descriptors: Anura, toads, frogs, defensive behavior.
Language of Text: Spanish.

McConville, J., L. Sterritt, and P.R. Laming (2006). **Behavioural responses to electrical and visual stimulation of the toad tectum.** *Behavioural Brain Research* 170(1): 15-22. ISSN: 0166-4328.
Abstract: Slow potential shifts in brain structures have been recorded and correlated with motivational state in several species. Previous studies have also found that application of an electrical current to the surface of brain tissue generates such slow potential shifts. The present study was conducted to examine if imposed dc shifts to the brain influenced motivation in the toad (*Bufo bufo*). Toads (*B. bufo*) had stimulating electrodes implanted on the surface of each optic tectum. After 1 day of recovery combined dc stimuli and a prey-like visual stimulus were presented to the animal. A current-dependent increase in prey-catching activities occurred with dc currents from 0.1 to 500 micro A and in avoidance behaviours from 50 to 500 micro A. There is also evidence of additivity of dc and visually induced negativity increasing some behaviours. The dc current was applied in order to start a movement of ions through the brain structure but more specifically through radial glia. The resulting flux of ions is thought to be responsible for the recorded slow potential shift associated with motivation and these experiments hopefully shed further light on the possible neuromodulatory role played by radial glia through the spatial buffering of potassium and the associated slow potential shifts.
Descriptors: toad, *Bufo bufo*, motivation, predatory behavior, superior colliculus, visual perception, attention, avoidance learning, brain mapping, electric stimulation, psychological extinction, feeding behavior, ion photic stimulation, potassium.

Mirza, R.S., M.C.O. Ferrari, J.M. Kiesecker, and D.P. Chivers (2006). **Responses of American toad tadpoles to predation cues: behavioural response thresholds, threat-sensitivity and acquired predation recognition**. *Behaviour* 143(Part 7): 877-889. ISSN: 0005-7959.
Descriptors: amphibians, toad, tadpoles, predation cues, behavioral responses, thresholds, threat sensitivity, predation recognition.

Moore, F.L., S.K. Boyd, and D.B. Kelley (2005). **Historical perspective: Hormonal regulation of behaviors in amphibians.** *Hormones and Behavior* 48(4): 373-383. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Descriptors: amphibians, hormonal regulation, behaviors, hormones, hormonal control of behaviors , review.

Shepard, D.B. (2004). **Seasonal differences in aggression and site tenacity in male Green Frogs, *Rana clamitans*.** *Copeia* 2004(1): 159-164. ISSN: 0045-8511.
Descriptors: green frogs, male, *Rana clamitans*, agression, seasonal differences, site tenacity.

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

Abrunhosa, P.A. and H. Wogel (2004). **Breeding behavior of the leaf-frog *Phyllomedusa burmeisteri* (Anura: Hylidae).** *Amphibia Reptilia* 25(2): 125-135. ISSN: 0173-5373.
Descriptors: leaf frog, *Phyllomedusa burmeisteri*, breeding behavior, males.

Andersen, F. (2006). **Hold og opdraet af dvaerg-pipatudsen (*Pipa parva*). [Care and breeding of the dwarf toad (*Pipa parva*).]**. *Nordisk Herpetologisk Forening* 49(4): 139-142. ISSN: 0900-484X.
Descriptors: dwarf toad, *Pipa parva*, diet in captivity, housing techniques, terrarium conditions, rearing techniques, terrarium conditions, diet significance, reproductive techniques, breeding techniques.
Language of Text: Danish; Summary in English.

Banks, C., J. Birkett, S. Young, M. Vincent, and T. Hawkes (2003). **Breeding and management of the great barred frog, *Mixophyes fasciolatus*, at Melbourne Zoo.** *Herpetofauna Sydney* 33(1): 2-12. ISSN: 0725-1424.
Descriptors: great barred frog, *Mixophyes fasciolatus*, care in captivity, breeding, management, reproductive, mamagement, Melbourne Zoo, Australia.

Beier, M. (2002). **Haltung und Zucht der Zwergwabenkroete *Pipa parva*. [Care and breeding of the dwarf toad *Pipa parva*.]**. *Reptilia D* 7(1): 64-71; Nr 33. ISSN: 1431-8997.
Descriptors: dwarf toad, *Pipa parva*, care, breeding, biological notes.
Language of Text: German.

Busse, K. (2006). **Die Nachzucht des Nasenfrosches *Rhinoderma darwinii* seit mehr als zwei Jahrzehnten. [The first breeding of Darwin's frog *Rhinoderma darwinii* for twenty years.]**. *Reptilia D* 11(4): 22-29 Nr 60. ISSN: 1431-8997.
Descriptors: Darwin's frog, *Rhinoderma darwinii*, care in captivity, methods for successful breeding, reproductive techniques, captive breeding, rearing.
Language of Text: German.

Dieltjes, R. (2005). **Een terrarium voor rietkikkers. [A terrarium for reed frogs.]**. *Aquarium Hilversum* 75(4): 114-117. ISSN: 0003-729X.
Descriptors: reed frogs, amphibians, terrarium, captive housing, care, breeding, captivity.
Language of Text: Dutch; Summary in Dutch.

Ficetola, G.F. and F. De Bernardi (2005). **Interspecific social interactions and breeding success of the frog *Rana latastei*: a field study.** *Ethology* 111(8): 764-774. ISSN: 0179-1613.
NAL Call Number: QL750.E74
Descriptors: amphibians, frog, *Rana latastei*, interspecific social interactions, breeding success, field study.

Harkewicz, K.A. (2006). **What's new in amphibian herpetoculture: care and husbandry of several species new to the pet trade.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 13: 5-7. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: frogs, amphibians, care, husbandry, pet trade, advances , conference proceedings.

Harkewicz, K.A. (2004). **Maintenance of *Bombina* species of frogs.** *Seminars in Avian and Exotic Pet Medicine* 13(4): 229-233. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: *Bombina*, frog, care in captivity, toad, handling, skin toxin, irritation, enclosures.

Hurme, K., K. Gonzalez, M. Halvorsen, B. Foster, D. Moore, and B.D. Chepko Sade (2003). **Environmental enrichment for dendrobatid frogs.** *Journal of Applied Animal Welfare Science* 6(4): 285-299. ISSN: 1088-8705.
NAL Call Number: HV4701.J68
Descriptors: dendrobatid frogs, environmental enrichment, strategies, evaluation, care in captivity, behavior.

Jungnickel, J. (2006). **Haltung und Nachzucht der Zwergwabenkroete (*Pipa parva* Ruthven & Gaige, 1923). [Husbandry and breeding of the dwarf toad (*Pipa parva* Ruthven & Gaige, 1923).]**. *Sauria* 28(1): 27-30. ISSN: 0176-9391.
Descriptors: *Pipa parva*, dwarf toad, care, husbandry, breeding.
Language of Text: German; Summary in English.

Kapfer, J.M. and S.N. Jones (2002). **A method for rearing and keeping the eastern tiger salamander, *Ambystoma tigrinum tigrinum*.** *Bulletin of the Chicago Herpetological Society* 37(2): 25-28. ISSN: 0009-3564.
Descriptors: amphibians, tiger salamander, *Ambystoma tigrinum tigrinum*, care in captivity , inexpensive and easlily replicable technique, rearing, keeping.

Kinne, O., J. Kunert, and W. Zimmermann (2004). **Breeding, rearing and raising the red-bellied toad *Bombina bombina* in the laboratory.** *Endangered Species Research* 3: 1-13. ISSN: print: 1863-5407; online: 1613-4796.
Online: http://dx.doi.org/10.3354/esr001011
Descriptors: *Bombina bombina*, red bellied toad, rearing, raising, breeding, captivity.

Lee, S., K. Zippeli, L. Ramos, and J. Searle (2006). **Captive-breeding programme for the kihansi spray toad *nectophrynoides asperginis* at the wildlife conservation society, Bronx, New York**. *International Zoo Yearbook* 40: 241-253. ISSN: 0074-9664.
Descriptors: amphibians, kihansi spray toad, *Nectophrynoides asperginis*, captive breeding program, wildlife conservation society, New York.

Lipp, H. (2004). **Die "madagassischen Pfeilgiftfroesche" - Haltung und Vermehrung von *Mantella*. [The "Madagascan poison arrow frogs" - care and breeding of *Mantella*.]**. *Draco* 5(3): 74-80 Nr 19. ISSN: 1439-8168.
Descriptors: amphibians, poison arrow frogs, *Mantella* breeding, care.
Language of Text: German.

Maceda Veiga, A. (2006). ***Bombina orientalis*: the oriental firebelly toad.** *Reptilia GB* 45: 78-82. ISSN: 1138-4913.
Descriptors: *Bombina orientalis*, oriental firebelly toad, captive care.

Mayer, T. (2003). **The captive care and breeding of *D. auratus* the green and black frog.** *Herptile* 28(4): 154-156. ISSN: 0953-2021.
Descriptors: green and black frog, *Dendrobates auratus*, care, breeding, captivity.

McRobert, S.P. (2003). **Methodologies for the care, maintenance, and breeding of tropical poison frogs.** *Journal of Applied Animal Welfare Science* 6(2): 95-102. ISSN: 1088-8705.
NAL Call Number: HV4701.J68
Descriptors: tropical poison frogs, Anura, care, maintenance, breeding, husbandry, methodologies.

Najvar, P.A., J.N. Fries, and J.T. Baccus (2007). **Fecundity of san marcos salamanders in captivity**. *Southwestern Naturalist* 52(1): 145-147. ISSN: 0038-4909.
NAL Call Number: 409.6 So8
Descriptors: amphibians, salamanders, fecundity, captivity, 24 pairs, flow through aquaria, hatching success, breeding, eggs.

Nigl, H. and H.J. Herrmann (2005). **Hornfroesche Die Arten der Gattung *Ceratophrys*, ihre Pflege und Zucht. [Horned frogs. The species of the genus *Ceratophrys* - their care and breeding.]**. *Aquaristik Fachmagazin and Aquarium Heute* 37(5): 98-101 Nr 185. ISSN: 1437-4854.
Descriptors: amphibians, Horned frogs, genus *Ceratophrys*, care, breeding.
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.

Palis, J.G., M.J. Aresco, and S. Kilpatrick (2006). **Breeding biology of a Florida population of *Ambystoma cingulatum* (Flatwoods salamander) during a drought.** *Southeastern Naturalist* 5(1): 1-8. ISSN: 1528-7092.

NAL Call Number: 409.6 So8
Descriptors: salamander, *Ambystoma cingulatum*, breeding biology, during drought period, Florida, USA.

Peterka, J., J. Matena, and B. Machackova (2003). **Chov a odchov rakosnicek *Hyperolius puncticulatus* (Pfeffer, 1893). [Captive care and rearing of the yellow-spotted reed frog *Hyperolius puncticulatus* (Pfeffer, 1893).]**. *Akvarium Terarium* 46(3): 60-65. ISSN: 0002-3930.
Descriptors: yellow spotted frog, *Hyperolius puncticulatus*, captive care, rearing, breeding, housing.
Language of Text: Czech.

Qian WeiPing (2004). **Study on artificial breeding technology of toad and growth law of clumped feeding**. *Journal of Economic Animal* 8(3): 157-160. ISSN: 1007-7448.
Descriptors: amphibians, toad, artificial breeding, technology, growth law, clumped feeding, study, rearing.
Language of Text: Chinese; Summary in English.

Rogner, M. (2006). **Pfeilgiftfroesche im Terrarium. [Poison arrow frogs in the terrarium.]**. *DATZ* 59(9): 16-20. ISSN: 0941-8393.
Descriptors: amphibians, poison arrow frogs, terrarium.
Language of Text: German; Summary in German.

Rogner, M. (2003). **Der Baumhoehlen-Kroetenlaubfrosch. Pflege und Zucht von *Phrynohyas resinifictrix*, Goeldi, 1907. [Care and breeding of the tree frog *Phrynohyas resinifictrix*, Goeldi, 1907.]**. *Aquarium Bornheim* 411: 62-68. ISSN: 0341-2709.
Descriptors: tree frog, *Phrynohyas resinifietrix*, care, breeding.
Language of Text: German; Summary in German.

Salewski, M. (2005). **Erfolgreiche Haltung und Zucht verschiedener Farbvarianten des Erdbeerfroeschchens, *Dendrobates pumilio* (Dendrobatidae). [Successful care and breeding of various colour variants of the strawberry poison-dart frog, *Dendrobates pumilio* (Dendrobatidae).]**. *Amphibia* 4(2): 12-18. ISSN: 0430-120X.
Descriptors: poison dart frog, *Dendrobates pumilio*, care, breeding, various color variants, captive care.
Language of Text: German.

Schaeffer, T. (2006). **Bau eines Regenwald-Terrariums fuer Pfeilgiftfroesche. [Construction of a rain forest terrarium for poison arrow frogs.]**. *Draco* 7(2): 59-63 Nr 26. ISSN: 1439-8168.
Descriptors: poison arrow frogs, rain forest terrarium, construction, housing, care, enrichment.
Language of Text: German.

Schiotz, A. (2004). **Ynglestrategier hos Afrikas lovfroer. [Breeding strategies for African tree frogs.]**. *Nordisk Herpetologisk Forening* 47(3): 82-85. ISSN: 0900-484X.
Descriptors: African tree frogs, breeding strategies, care, reproduction.
Language of Text: Danish; Summary in English.

Soden, S. (2005). **Breeding giant wax monkey frogs: *Phyllomedusa bicolor.*** *Reptilia GB* 39: 32-37. ISSN: 1138-4913.
Descriptors: giant wax monkey frogs, breeding, *Phyllomedusa bicolor.*

St Claire, M.B., M.J. Kennett, M.L. Thomas, and J.W. Daly (2005). **The husbandry and care of dendrobatid frogs.** *Contemporary Topics in Laboratory Animal Science* 44(6): 8-14. ISSN: 1060-0558.
NAL Call Number: SF405.5.A23
Descriptors: frogs, frog culture, laboratory animals, sexual dimorphism, sexual behavior, alkaloids, skin glands, Phyllobates, Dendrobates, Epipedobates.

Staniszewski, M. (2003). **Keeping the European tree frog in captivity *Hyla arborea.*** *Reptilia GB* 28: 26-28. ISSN: 1138-4913.
Descriptors: tree frog, *Hyla arborea*, care, captivity.

Staniszewski, M. (2002). **Aneides, natural history and captive care of climbing salamanders.** *Reptilia GB* 23: 23-27. ISSN: 1138-4913.
Descriptors: amphibians, salamander, Aneides, biological notes, care in captivity.

Vaira, M. (2005). **Annual variation of breeding patterns of the toad, *Melanophryniscus rubriventris* (Vellard, 1947).** *Amphibia Reptilia* 26(2): 193-199. ISSN: 0173-5373.
Descriptors: toad, *Melanophryniscus rubriventris*, breeding patterns, annual variation.

Voitel, S. (2003). **Pflege und Zucht des asiatischen Frosches *Paa exilispinosa.* [Care and breeding of the Asian frog *Paa exilispinosa.*]**. *Aquaristik Fachmagazin and Aquarium Heute* 35(4): 88-91 Nr 172. ISSN: 1437-4854.
Descriptors: Asian frog, *Paa exilispinosa*, care, breeding.
Language of Text: German.

Wilms, T., B. Kuegelgen, and T. Schreckenbach (2005). **Zur Haltung, Pflege und Vermehrung des Baumhoehlen-Kroetenlaubfrosches, *Trachycephalus resinifictrix* (Goeldi, 1907) im Reptilium Landau. [The husbandry, care and breeding of the bone-headed tree frog *Trachycephalus resinifictrix* (Goeldi, 1907) in the Landau reptile house.]**. *Draco* 6(3): 66-72 Nr 23. ISSN: 1439-8168.
Descriptors: bone headed tree frog, *Trachycephalus resinifictrix*, husbandry, care, breeding, Landau.
Language of Text: German.

Cardiovascular

Ahmad, M., M. Ahmad, R. Hasan, and A. Qureshi (2005). **The effects of isoniazid (INH) on the hematocrit of the lizard, *Uromastix hardwickii*.** *Pakistan Journal of Pharmaceutical Sciences* 18(1): 52-54. ISSN: 1011-601X.

Abstract: In recent years isoniazid has been used as an antituberculous chemophylactic agent. Severe adverse reactions have been reported following its extensive treatment. In addition to hepatic and neurologic disturbances, hematologic alterations have also been reported. Present study was conducted to determine the effect of 0.06 mg isoniazid on the lacertilian packed cell volume. It was 14.0 per cent on day 5, 18.0 and 19.8 per cent on day 10 and day 15 respectively, whereas, it was 24.0, 24.2 and 24.6 per cent in controls on day 5, 10 and day 15 respectively.

Descriptors: lizard, antitubercular agents adverse effects, erythrocytes drug effects, iguanas blood, isoniazid adverse effects, administration, oral, erythrocytes cytology, hematocrit.

Ahmad, M., R. Hasan, M. Ahmad, A. Qureshi, Z. Ahmed, and S. Mansoor (2005). **The effects of mefenamic acid on the blood haemoglobin of the lizard, *Uromastix hardwickii*.** *Pakistan Journal of Pharmaceutical Sciences* 18(4): 41-45. ISSN: 1011-601X.

Abstract: This study deals with the effect of 7.1 mg/day, 10.5 mg/day and 14 mg/day doses of mefenamic acid administered for 12 days to three groups of *Uromastix hardwickii* respectively. Individual blood samples were obtained from the anterior abdominal vein and hemoglobin content was determined. The hemoglobin in test was 5.1 g/100 ml compared to 8.0 g/100 ml of controls in experiment I and its amount remained almost similar in the case of experiment II, whereas, 4.5 g/100 ml was observed of test compared to 8.0 g/100 ml of their counterparts.

Descriptors: anti-inflammatory agents, non steroidal pharmacology, hemoglobins metabolism, lizards, mefenamic acid, methemoglobin, reference standards.

Alberio, S.O., J.A. Diniz, E.O. Silva, W. de Souza, and R.A. DaMatta (2005). **Cytochemical and functional characterization of blood and inflammatory cells from the lizard *Ameiva ameiva*.** *Tissue and Cell* 37(3): 193-202. ISSN: 0040-8166.

NAL Call Number: QH573.T5

Abstract: The fine structure and differential cell count of blood and coelomic exudate leukocytes were studied with the aim to identify granulocytes from *Ameiva ameiva*, a lizard distributed in the tropical regions of the Americas. Blood leukocytes were separated with a Percoll cushion and coelomic exudate cells were obtained 24 h after intracoelomic thioglycollate injection. In the blood, erythrocytes, monocytes, thrombocytes, lymphocytes, plasma cells and four types of granulocytes were identified based on their morphology and cytochemistry. Types I and III granulocytes had round intracytoplasmic granules with the same basic morphology; however, type III granulocyte had a bilobued nucleus and higher amounts of heterochromatin suggesting an advance stage of maturation. Type II granulocytes had fusiformic granules and more mitochondria. Type IV granulocytes were classified as the

basophil mammalian counterpart based on their morphology and relative number. Macrophages and granulocytes type III were found in the normal coelomic cavity. However, after the thioglycollate injection the number of type III granulocyte increased. Granulocytes found in the coelomic cavity were related to type III blood granulocyte based on the morphology and cytochemical localization of alkaline phosphatase and basic proteins in their intracytoplasmic granules. Differential blood leukocyte counts showed a predominance of type III granulocyte followed by lymphocyte, type I granulocyte, type II granulocyte, monocyte and type IV granulocyte. Taken together, these results indicate that types I and III granulocytes correspond to the mammalian neutrophils/heterophils and type II to the eosinophil granulocytes.
Descriptors: lizard blood, blood platelets ultrastructure, erythrocytes ultrastructure, granulocytes ultrastructure, lizard anatomy, histology, lymphocytes ultrastructure, electron microscopy, transmission, monocytes ultrastructure.

Andersen, J.B., M.S. Hedrick, and T. Wang (2003). **Cardiovascular responses to hypoxia and anaemia in the toad *bufo marinus*.** *Journal of Experimental Biology* 206(5): 857-865. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.00184
NAL Call Number: 442.8 B77
Descriptors: amphibians, toad, anemia, hypoxia, cardiovascular, ventilatory responses, arterial carbon dioxide partial pressure.

Arikan, H., M.K. Atatur, and M. Tosunoglu (2003). **A study on the blood cells of the Caucasus Frog, *Pelodytes caucasicus*.** *Zoology in the Middle East* 30: 43-47. ISSN: 0939-7140.
Descriptors: amphibian, *Pelodytes caucasicus*, size, blood cells, study, characterization, Caucasus frog.
Language of Text: English; German.

Basaglia, F. (2004). **Comparative study of electrophoretic and isoelectrophoretic characteristics of osteichthyan and amphibian hemoglobin.** *Italian Journal of Zoology* 71(4): 287-295. ISSN: 1125-0003.
NAL Call Number: QL1.B55
Descriptors: amphibians, osteichthyes, hemoglobin, electrophoretic and isoelectrophoretic characteristics, comparative study.

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.

Cerra, M.C., D. Amelio, P. Tavolaro, A. Palma, V. Marciano, and F. Farina (2003). **Pericardium of the frog, *Rana esculenta*, is morphologically designed as a lymphatic space.** *Journal of Morphology* 257(1): 72-77. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: amphibians, frog, pericardium, lymphatic space, morphologically, pericardial fluid, cardiac function, control.

Coolidge, E.H., M.J. MacAulay, and D.P. Toews (2006). **Synchrony in the amphibian lymphatic system: evidence for bilateral posterior lymph heart synchrony and cardiac-lymphatic synchrony in *Rana catesbeiana* and *Bufo marinus*.** *Canadian Journal of Zoology* 84(3): 374-382. ISSN: 0008-4301.
NAL Call Number: 470 C16D
Descriptors: amphibian, *Rana catesbeiana*, *Bufo marinus*, lymphaticsystem, cardiac lymphatic synchrony, heart function.
Language of Text: English; French.

Coskun, B., U. Comelekoglu, A. Polat, and F.F. Kaymaz (2004). **Evaluation of the toxic effects of cypermethrin inhalation on the frog heart.** *Ecotoxicology and Environmental Safety* 57(2): 220-225. ISSN: 0147-6513.
NAL Call Number: QH545.A1E29
Descriptors: frog heart, toxic effects, cypermethrin inhalation, evaluation.

Cox, C.M., S.L. D'agostino, M.K. Miller, R.L. Heimark, and P.A. Krieg (2006). **Apelin, the ligand for the endothelial g-protein-coupled receptor, apj, is a potent angiogenic factor required for normal vascular development of the frog embryo**. *Developmental Biology* 296(1): 177-189. ISSN: 0012-1606.
Descriptors: amphibians, *Xenopus*, frog embryo, vascular development, apelin, peptide growth factor, angiogenic factor.

Donald, J.A. and S. Trajanovska (2006). **A perspective on the role of natriuretic peptides in amphibian osmoregulation.** *General and Comparative Endocrinology* 147(1): 47-53. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: The natriuretic peptide (NP) system is a complex family of peptides and receptors that is primarily linked to the maintenance of osmotic and cardiovascular homeostasis. In amphibians, the potential role(s) of NPs is complicated by the range of osmoregulatory strategies found in amphibians, and the different tissues that participate in osmoregulation. Atrial NP, brain NP, and C-type NP have been isolated or cloned from a number of species, which has enabled physiological studies to be performed with homologous peptides. In addition, three types of NP receptors have been cloned and partially characterised. Natriuretic peptides are always potent vasodilators in amphibian blood vessels, and ANP has been shown to increase the permeability of the microcirculation. In the perfused kidney, ANP causes vasodilation, diuresis and natriuresis that are caused by an increased GFR rather than effects in the renal tubules. These data are supported by the presence of ANP receptors only on the

glomeruli and renal blood vessels. In the bladder and skin, the function of NPs is enigmatic because physiological analysis of the effects of ANP on bladder and skin function has yielded conflicting data with no clear role for NPs being revealed. Overall, NPs often have no direct effect, but in some studies they have been shown to inhibit the function of AVT. In addition, there is evidence that ANP can inhibit salt retention in amphibians since it can inhibit the ability of adrenocorticotrophic hormone or angiotensin II to stimulate corticosteroid secretion. It is proposed that an important role for cardiac NPs could be in the control of hypervolaemia during periods of rapid rehydration, which occurs in terrestrial amphibians.
Descriptors: *Bufo marinus*, amphibian physiology, natriuretic peptides physiology, water electrolyte balance, amino acid sequence, amphibia blood, base sequence, brain metabolism, *Bufo marinus* genetics, models, biological, molecular sequence data, natriuretic peptides blood, natriuretic peptides chemistry, plasma volume, protein structure, secondary, sequence homology, amino acid.

El Sayed, M.F. (2002). **The effect of interaction between adrenaline and caffeine on the cardiac contractions developed after 5 minutes of rest in catfish and frog.** *Journal of the Egyptian German Society of Zoology* 37(A): 319-339. ISSN: 1110-5356.
NAL Call Number: QL1.E49
Descriptors: frog, catfish, neurotransmitters, heart beat, adrenaline and caffeine, interactive effects, cardiac contractions.
Language of Text: Arabic; English.

Ezhili, N., A.A. Sivakumar, and M. Aruchami (2003). **Effect of acid pollution on the haemoglobin and haemotological picture in the frog, *Rana hexadactyla* (Lesson)**. *Journal of Eco Physiology* 6(1/2): 25-32. ISSN: 0972-0413.
Descriptors: amphibians, frog, *Rana hexadactyla*, acid pollution, effect, hemoglobin, hemotological picture.

Gaitanaki, C., M. Papatriantafyllou, K. Stathopoulou, and I. Beis (2006). **Effects of various oxidants and antioxidants on the p38-MAPK signalling pathway in the perfused amphibian heart.** *Molecular and Cellular Biochemistry* 291(1): 107-117. ISSN: 0300-8177.
Abstract: We investigated the effects of different antioxidants such as L-ascorbic acid, catalase, and superoxide dismutase (SOD), on the p38-MAPK activation induced by oxidative stress in the isolated perfused amphibian heart. Oxidative stress was exemplified by perfusing hearts with 30 (So(BM H subscript 2(BO subscript 2(B for 5 min or with the enzymatic system of xanthine/xanthine oxidase (200 (So(BM/10 mU/ml, respectively) for 10 min. H subscript 2(BO subscript 2(B-induced activation of p38-MAPK (7.04 +/- 0.20-fold relative to control values) was totally attenuated by L-ascorbic acid (100 (So(BM) or catalase (150 U/ml). These results were confirmed by immunohistochemical studies in which the phosphorylated form of p38-MAPK was localised in the perinuclear region and dispersedly in the cytoplasm of the ventricular cells during H subscript 2(BO subscript 2(B treatment, a pattern that was abolished by catalase or L-ascorbic acid. p38-MAPK was also activated (2.34+/- 0.17-fold) by perfusing amphibian hearts with the reactive oxygen species (ROS)-generating system of xanthine/xanthine oxidase and this activation sustained in the presence

of 150 U/ml catalase (2.16 +/- 0.26-fold), 50 U/ml SOD (2.02 +/-0.07) or 100 (So(BM L-ascorbic acid (2.18 +/- 0.10), but was suppressed by the combination of 150 U/ml catalase and 50 U/ml SOD. Finally, our studies showed that xanthine/xanthine oxidase induced the phosphorylation of the potent p38-MAPK substrates MAPKAPK2 (3.14 +/- 0.27-fold) and HSP27 (5.32 +/- 0.83-fold), which are implicated in cell protection, and this activation was reduced by the simultaneous use of catalase and SOD.
Descriptors: amphibians, antioxidants, oxidative stress, signal transduction, xanthine oxidase, amphibian heart, HSP27, p38 MAPK, *Rana ridibunda*.

Gautam, C.S., P.K. Sharma, and N.K. Goel (2002). **Depressant effect of tramadol on frog heart**. *Indian Journal of Pharmacology* 34(3): 202-203. ISSN: 0253-7613.
Descriptors: amphibians, frog, tremadol, heart, depressant effect, cardiovascular.

Hillman, S.S., N. Brill, and P. Withers (2002). **Amphibians as models for a leaky circulatory system**. *FASEB Journal* 16(5): A884-A885. ISSN: 0892-6638.
NAL Call Number: QH301.F3
Descriptors: amphibians, toad, bullfrog, animal models, circulatory system, leaky, blood volume, plasma volume, turnover.
Notes: Meeting Information: Annual Meeting of Professional Research Scientists on Experimental Biology, New Orleans, Louisiana, USA; April 20-24, 2002.

Lisboa, M.C., A.P.F. Melo, R.H.S. Ferraz, and R.F. Rodrigues (2003). **Topografia e irrigacao do oviduto de ra (*Rana catesbeiana*, shaw, 1802). [Oviduct topography and arterial vascularization of frog (*Rana catesbeiana*, shaw, 1802).]**. *Revista Brasileira De Reproducao Animal* 27(2): 292-294. ISSN: 0102-0803.
NAL Call Number: QP251.R48
Descriptors: amphibians, frog, cardiovascular, arterial vascularization, oviduct topography, anatomy.
Language of Text: Portuguese.

Marszalek Mikulcik, P. and L.A. Maginniss (2006). **Effects of exhaustive exercise on blood-o-2 transport in northern leopard frogs (*Rana pipiens*)**. *FASEB Journal* 20(5, Part 2): A822. ISSN: 0892-6638.
NAL Call Number: QH301.F3
Descriptors: amphibians, leopard frogs, *Rana pipiens*, exhaustive exercise, effects, blood Q2 transport, aerobic metabolism, meeting.
Notes: Meeting Information: Experimental Biology 2006 Meeting, San Francisco, CA, USA; April 1 -5, 2006.

Mazza, R., S. Imbrogno, T. Angelone, A. Corti, K.B. Helle, and B. Tota (2003). **Cardiosuppressor activity of vasostatins in eel and frog.** *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 134A(Suppl. 1): S48. ISSN: 1095-6433.
Descriptors: amphibians, frog, eel, vasostatins, cardiosuppressor activity.

Notes: Meeting Information: Sixth International Congress of Comparative Physiology and Biochemistry, Mt. Buller, Australia; February 02-07, 2003.

McKean, T., G. Li, and K. Wei (2002). **Cardiac effects of hypoxia in the neotenous tiger salamander *Ambystoma tigrinum.*** *Journal of Experimental Biology* 205(12): 1725-1734. ISSN: 0022-0949.
NAL Call Number: 442.8 B77
Descriptors: amphibians, tiger salamander, *Ambystoma tigrinum*, hypoxia, cardiac effects, cardiac output, cardiac mass, oxygen consumption.

Palenske, N.M. and D.K. Saunders (2002). **Comparisons of blood viscosity between amphibians and mammals at 3[degree]C and 38[degree]C.** *Journal of Thermal Biology* 27(6): 479-484. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: amphibians, mammals, blood viscosity, comparison, endotherms, ectotherms, temperature.

Plane, S.J. and S.J. Warburton (2002). **High catecholamine environment: developmental cardiac effects in the amphibian, *Xenopus laevis*.** *FASEB Journal* 16(5): A886. ISSN: print: 0892-6638; online: 1530-6860.
NAL Call Number: QH301.F3
Descriptors: amphibians, frog, *Xenopus laevis*, developmental cardiac effects, high catecholamine environment, chronic epinephrine esposure, meeting.
Notes: Meeting Information: Annual Meeting of Professional Research Scientists on Experimental Biology, New Orleans, Louisiana, USA; April 20-24, 2002.

Romanova, E.B. and M.N. Egorikhina (2006). **Changes in hematological parameters of *Rana* frogs in a transformed urban environment.** *Russian Journal of Ecology* 37(3): 188-192. ISSN: 1067-4136.
Descriptors: *Rana*, blood, hematological parameter change, transformed urban environment, immune response, Russia.

Singh, S.S. and M. Singh (2002). **Detection of pulsatile blood flow cycle in frog microvessels by image velocimetry**. *Medical and Biological Engineering and Computing* 40(3): 269-272. ISSN: print: 0140-0118; online: 1741-0444.
Descriptors: amphibians, frog, pulsatile blood flow cycle, detection, microvessels, image velocimetry, mesenteric microvessel.

Subramani, S., E. Tharion, and C. Vijayanand (2002). **Novel action of some organic calcium channel blockers on frog myocardium.** *Journal of Physiology* 543P: 8P-9P. ISSN: 0022-3751.
NAL Call Number: 447.8 J82
Descriptors: amphibians, frog, myocardium, organic calcium channel blockers, novel action, meeting.

Notes: Meeting Information: Scientific Meeting of the Physiological Society, Lancashire, England, UK; May 9-10, 2002.

Tota, B. (2003). **Modulation of cardiac performance in teleosts and amphibians: nitric oxide-cgmp mechanisms.** *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 134A(Suppl. 1): S46-S47. ISSN: 1095-6433.
Descriptors: amphibians, cardiac performance, modulation, teleosts, nitric oxide-cgmp mechanisms, meeting.
Notes: Meeting Information: Sixth International Congress of Comparative Physiology and Biochemistry, Mt Buller, Australia; February 2-7, 2003.

Wojtaszek, J. and A. Adamowicz (2003). **Haematology of the fire-bellied toad, *Bombina bombina* L.** *Comparative Clinical Pathology* 12(3): 129-134. ISSN: 1618-5641.
Descriptors: fire bellied toad, *Bombina bombina*, hematology.

Yadav, R.K. and N.S. Verma (2004). **Effects of garlic (*allium sativum*) extract on the heart rate, rhythm and force of contraction in frog: a dose-dependent study**. *Indian Journal of Experimental Biology* 42(6): 628-631. ISSN: 0019-5189.
NAL Call Number: 442.8 IN2
Descriptors: amphibians, frog, cardiovascular system, garlic effects, bradycardia, force of contraction, heart rate, ventricular rhythm.

Yu, S.Y., K.Y. Si, Z.H. Liu, Z.R. Wang, and J.L. Wang (2004). **Compare observation on the micro-vascular casts of the lungs of lizard and toad.** *Journal of the Northwest Normal University Natural Sciences* 40(2): 55-58. ISSN: 1001-988X.
Descriptors: lizard, toad, amphibians, *Bufo raddei*, blood vessels, lungs, microvascular casts.
Language of Text: Chinese; Summary in Chinese and English.

Diet, Nutrition and Metabolism

Alavarado Diaz, J., P. Garcia Garrido, and I. Suazo Ortuno (2003). **Food habits of a paedomorphic population of the mexican salamander, *Ambystoma ordinarium* (caudata: ambystomatidae).** *Southwestern Naturalist* 48(1): 100-102. ISSN: 0038-4909.
NAL Call Number: 409.6 So8
Descriptors: amphibians, salamander , *Ambyostoma ordinarium*, feeding habits, diet, caddfishfly larvae, grasshoppers, small pedomorphs.

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.

Arendt, J. and L. Hoang (2005). **Effect of food level and rearing temperature on burst speed and muscle composition of western spadefoot toad (*Spea hammondii*).** *Functional Ecology* 19(6): 982-987. ISSN: 0269-8463.
NAL Call Number: QH540.F85
Descriptors: amphibians, western spadefoot toad, *Spea hammondii*, food level, rearing temperature, burst speed, muscle composition, effect.

Beane, J.C. and L.T. Pusser (2005). ***Bufo terrestris* (southern toad). Diet and scavenging behavior.** *Herpetological Review* 36(4): 432. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: amphibians, toad, *Bufo terrestris*, diet, scavenging behavior.

Castaneda Gaytan, G., C. Garcia De La Pena, D. Lazcano, and A.J. Contreras Balderas (2006). **Dietary composition of the Mexican spadefoot toad (*Spea multiplicata*) from a sand dune habitat in southwestern Coahuila, Mexico**. *Texas Journal of Science* 58(1): 55-64. ISSN: 0040-4403.
Descriptors: amphibians, spadefoot toad, *Spea multiplicata*, dietary composition, Mexico, sand dune system, arthropods, ants, vegetal, diet composition.

Castaneda, L.E., P. Sabat, S.P. Gonzalez, and R.F. Nespolo (2006). **Digestive plasticity in tadpoles of the chilean giant frog (*Caudiverbera caudiverbera*): factorial effects of diet and temperature**. *Physiological and Biochemical Zoology* 79(5): 919-926. ISSN: 1522-2152.
NAL Call Number: QL1.P52

Descriptors: amphibians, giant frog, digestive plasticity, factorial effects, diet, temperature, *Caudiverbera caudiverbera.*

Cook, K., S. Droege, and A.R. Kellogg (2002). **Stomach content analysis of 13 North American toad species**. *Bulletin of the Maryland Herpetological Society* 38(3): 75-85. ISSN: 0025-4231.
NAL Call Number: QL640.M3
Descriptors: amphibians, toads, 13 species, stomach contents, analysis, summaries, North american species.

Cramp, R.L. and C.E. Franklin (2005). **Arousal and re-feeding rapidly restores digestive tract morphology following aestivation in green-striped burrowing frogs.** *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 142(4): 451-460. ISSN: 1095-6433.
Descriptors: striped burrowing frogs, *Cyclorana alboguttata*, estivation, intestinal morphology, restoration, arousal, refeeding.

Cramp, R.L., C.E. Franklin, and E.A. Meyer (2005). **The impact of prolonged fasting during aestivation on the structure of the small intestine in the green-striped burrowing frog, *Cyclorana alboguttata.*** *Acta Zoologica Copenhagen* 86(1): 13-24. ISSN: 0001-7272.
Descriptors: amphibians, frog, *Cyclorana alboguttata*, short-term fasting, long-term fasting, estivation, effects, small intestine.

Dixit, P.K. and H.N. Behera (2002). **Studies on carbohydrate metabolism in tissues of toad, *Bufo melanostictus* following cold-stress and thyroxine treatment.** *Journal of Animal Morphology and Physiology* 49(1-2): 59-70. ISSN: 0021-8804.
NAL Call Number: 444.8 J823
Descriptors: amphibians, toad, *Bufo melanostictus*, cold stress, carbohydrate metabolism, thyroxine treatment, tissues.

Emelyanova, L.V., E.M. Koroleva, and M.V. Savina (2004). **Glucose and free amino acids in the blood of lampreys (*Lampetra fluviatilis* L.) and frogs (*Rana temporaria* L.) under prolonged starvation.** *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 138A(4): 527-532. ISSN: 1095-6433.
Descriptors: amphibians, frogs, *Rana temporaria*, lampreys, *Lampetra fluviatilis*, prolonged starvation, glucose, free amino acids, blood.

Finkler, M.S. (2006). **Effects of temperature, sex, and gravidity on the metabolism of small-mouthed salamanders, *Ambystoma texanum*, during the reproductive season**. *Journal of Herpetology* 40(1): 103-106. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: amphibians, small mouthed salamander, *Ambystoma texanum*, metabolism, temperature, sex, gravidity, effects, reproductive season.

Finkler, M.S. and K.A. Cullum (2002). **Sex-related differences in metabolic rate and energy reserves in spring-breeding small-mouthed salamanders (*Ambystoma texanum*).** *Copeia* 2002(3): 824-829. ISSN: 0045-8511.
Descriptors: small mouthed salamanders, *Ambystoma texanum*, oxygen consumption, respiratory quotient, carbohydrates, energy budget, energy reserves, reproduction, physiological and biochemical sex differences, metabolic rate and energy reserves, relations with spring breeding, breeding season, energetic costs of spring breeding, sex differences.

Gomes, F.R., J.G. Chaui Berlinck, J.E. Bicudo, and C.A. Navas (2004). **Intraspecific relationships between resting and activity metabolism in anuran amphibians: influence of ecology and behavior.** *Physiological and Biochemical Zoology* 77(2): 197-208. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: The aerobic capacity model, as well as other models for the evolution of aerobic metabolism and the origin of endothermy, requires a mechanistic link between rates of resting and activity oxygen consumption (VO2rest and VO2act). The existence of such link is still controversial, but studies with anuran amphibians support a correlation between VO2rest and VO2act at both the intraspecific and interspecific levels. Because results at the intraspecific level are based only on a few species, we test for the generality of a link between these two metabolic variables in anurans by studying the intraspecific correlational patterns between mass-independent VO2rest and VO2act in anurans. We focus on 21 Neotropical species from different geographical areas that include remarkable diversity in behavior and thermal ecology. Although uncorrelated, VO2rest and VO2act seem to be consistent among individuals. Diverse intraspecific phenotypic correlational trends were detected, indicating that the intraspecific relationships between VO2rest and VO2act might be very diverse in anurans. The three possible trends (positive, negative, and absent correlations) were observed and appeared to be predictable from ecological and behavioral variables that relate to evolutionary physiological shifts in anurans. Positive correlations between VO2rest and VO2act were more common in species with active lifestyles (e.g., intense vocal activity) and in species that call at low temperatures (e.g., winter or high-elevation specialists).
Descriptors: anuran amphibians, ecology, behavior, metabolism, active, resting, intraspecific relationships, aerobic capacity model.

Gordon, N.M. (2004). **The effect of supplemental feeding on the territorial behavior of the green frog (*Rana clamitans*).** *Amphibia Reptilia* 25(1): 55-62. ISSN: 0173-5373.
Descriptors: *Rana clamitans*, green frog, supplemental feeding, effect, ter ritorial behavior.

Hadfield, C.A., L.A. Clayton, and S.L. Barnett (2006). **Nutritional support of amphibians**. *Journal of Exotic Pet Medicine* 15(4): 255-263. ISSN: 1557-5063.
Online: http://www.sciencedirect.com/science/journal/15575063
NAL Call Number: SF994.2.A1 S36
Descriptors: amphibians, frogs, toads, salamanders, nutritional support, body condition, contraindications, hydration, husbandry, liquid diet.

Huntington, B. (2005). **Cultured critters: raising live foods for small fish and aquatic amphibians.** *Proceedings of the National Conference of the American Association of Zoo Keepers Inc* 31: 130-138. ISSN: 0164-9531.
Descriptors: aquatic amphibians, small fish, raising live foods, cultured, feeding.

Iwai, N. and T. Kagaya (2005). **Larval food habits of the forest green tree frog.** *Bulletin of the Herpetological Society of Japan* 2: 100-102. ISSN: 1345-5826.
Descriptors: green tree frog, diet, larval food habits, food preferences, larval development, growth.
Language of Text: Japanese; Summary in English.

Iwai, N. and T. Kagaya (2005). **Growth of Japanese toad (*Bufo japonicus formosus*) tadpoles fed different food items.** *Current Herpetology* 24(2): 85-89. ISSN: 1345-5834.
Descriptors: amphibians, toad, *Bufo japonicus formosus*, diet, tadpoles, growth, different food items.

Kumbar, S.M. and K. Pancharatna (2002). **Frequency of feeding and formation of bone growth marks in frog, *Rana cyanophlyctis* (schn.)**. *Indian Journal of Experimental Biology* 40(9): 1074-1076. ISSN: 0019-5189.
NAL Call Number: 442.8 IN2
Descriptors: amphibians, frog, *Rana cyanophlyctis*, feeding frequency, formation of bone growth marks, live guppies, seasonal rainfall.

Kupfer, A., H. Muller, M.M. Antoniazzi, C. Jared, H. Greven, R.A. Nussbaum, and M. Wilkinson (2006). **Parental investment by skin feeding in a caecilian amphibian.** *Nature* 440(7086): 926-929. ISSN: print: 0028-0836; online: 1476-4687.
NAL Call Number: 472 N21
Abstract: Although the initial growth and development of most multicellular animals depends on the provision of yolk, there are many varied contrivances by which animals provide additional or alternative investment in their offspring. Providing offspring with additional nutrition should be favoured by natural selection when the consequent increased fitness of the young offsets any corresponding reduction in fecundity. Alternative forms of nutrition may allow parents to delay and potentially redirect their investment. Here we report a remarkable form of parental care and mechanism of parent-offspring nutrient transfer in a caecilian amphibian. *Boulengerula taitanus* is a direct-developing, oviparous caecilian, the skin of which is transformed in brooding females to provide a rich supply of nutrients for the developing offspring. Young animals are equipped with a specialized dentition, which they use to peel and eat the outer layer of their mother's modified skin. This new form of parental care provides a plausible intermediate stage in the evolution of viviparity in caecilians. At independence, offspring of viviparous and of oviparous dermatotrophic caecilians are relatively large despite being provided with relatively little yolk. The specialized dentition of skin-feeding (dermatophagous) caecilians may constitute a preadaptation to the fetal feeding on the oviduct lining of viviparous caecilians.
Descriptors: *Boulengerula taitanus*, amphibia anatomy and histology, animal nutrition,

mothers, skin anatomy and histology, oviparity, selection genetics, tooth anatomy and histology.

Maneyro, R., D.E. Naya, I. Da Rosa, A. Canavero, and A. Camargo (2004). **Diet of the South American frog *Leptodactylus ocellatus* (Anura, Leptodactylidae) in Uruguay**. *Iheringia Serie Zoologia* 94(1): 57-61. ISSN: 0073-4721.
Descriptors: amphbians, frog, *Leptodactylus ocellatus*, diet, South American, stomach contents, preditor and prey sizes, Uruguay.

Marszalek Mikulcik, P. and L.A. Maginniss (2006). **Effects of exhaustive exercise on blood-o-2 transport in northern leopard frogs (*Rana pipiens*)**. *FASEB Journal* 20(5, Part 2): A822. ISSN: 0892-6638.
NAL Call Number: QH301.F3
Descriptors: amphibians, leopard frogs, *Rana pipiens*, exhaustive exercise, effects, blood Q2 transport, aerobic metabolism, meeting.
Notes: Meeting Information: Experimental Biology 2006 Meeting, San Francisco, CA, USA; April 1 -5, 2006.

Martinez, I.P., M. Real, and R. Alvarez (2004). **Growth of *Rana perezi* Seoane, 1885 froglets fed on diets with different nutrient compositions.** *Aquaculture* 241(1-4): 387-394. ISSN: 0044-8486.
Abstract: There are no data available about the nutritional requirements of *Rana perezi* froglets reared under controlled conditions. Four experimental groups of froglets (newly metamorphosed tadpoles) were fed on four types of trout fodder with different nutritional compositions. Survival rates and other growth parameters were studied in the four groups over 120 days. The results revealed that grow-out was better with protein contents between 46% and 50%, and fat percentages of 20-22%. Among the four diets tested, the best results were achieved using the one with a nutritional composition of 46% protein, 22% lipids, and 13.5% carbohydrates.
Descriptors: *Rana perezi*, frogs, mortality, body weight, weight gain, feeds, trout, feed composition.

McCallum, M.L. and S.E. Trauth (2002). **Performance of wood frog tadpoles (*Rana sylvaticus*) on three soybean meal-corn meal rations.** *Podarcis* 3(3): 78-85. ISSN: 1567-3871.
Online: http://www.podarcis.nl/main_eng.php3
Descriptors: amphibians, *Rana sylvaticus* , wood frog tadpoles, diet, captivity, three soybean meal-corn meal rations, performance.

Naya, D.E. and F. Bozinovic (2004). **Digestive phenotypic flexibility in post-metamorphic amphibians: studies on a model organism.** *Biological Research* 37(3): 365-370. ISSN: 0716-9760.
Abstract: Studies of phenotypic flexibility are central to the understanding of evolutionary and comparative physiology. Research conducted on many vertebrate species has shown that the digestive system is highly responsive and sensitive to environmental cues. However,

amphibians, which are a standard and classic model organism for the study of many physiological processes, have been poorly considered in the study of ecological consequences on digestive flexibility. Here we review and analyze the current information on this topic for amphibians. We identify three major bodies of empirical evidence: a) seasonal changes in gut development, b) lack of dietary modulation of gut attributes in adult individuals, c) a relationship between feeding habits and the magnitude of digestive performance regulation. Once the natural history characteristics of the species under study are taken into account, all the evidence is in full agreement with the predictions of digestive theory. We propose that evolutionary and comparative physiology could benefit greatly from the study of phenotypic flexibility in amphibians.
Descriptors: amphibians, adaptation, physiology, digestion physiology, evolution, phenotype, genetics, digestion genetics, food habits.

Ruchin, A.B. and M.K. Ryzhov (2002). **On the diet of the marsh frog (*Rana ridibunda*) in the Sura and Moksha watershed, Mordovia.** *Advances in Amphibian Research in the Former Soviet Union* 7: 197-205. ISSN: 1310-8840.
Descriptors: amphibian, marsh frog, *Rana ridibunda*, diet, watershed, Mordovia.
Language of Text: English; Russian.

Secor, S.M. and M. Boehm (2006). **Specific dynamic action of ambystomatid salamanders and the effects of meal size, meal type, and body temperature.** *Physiological and Biochemical Zoology* 79(4): 720-735. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: The past decade has witnessed a dramatic increase in studies of amphibian and reptile specific dynamic action (SDA). These studies have demonstrated that SDA, the summed energy expended on meal digestion and assimilation, is affected significantly by meal size, meal type, and body size and to some extent by body temperature. While much of this attention has been directed at anuran and reptile SDA, we investigated the effects of meal size, meal type, and body temperature on the postprandial metabolic responses and the SDA of the tiger salamander (*Ambystoma tigrinum tigrinum*). We also compared the SDA responses among six species of *Ambystoma* salamanders representing the breadth of Ambystoma phylogeny. Postprandial peaks in VO(2) and VO(2), duration of elevated metabolism, and SDA of tiger salamanders increased with the size of cricket meals (2.5%-12.5% of body mass). For A. tigrinum, as for other ectotherms, a doubling of meal size results in an approximate doubling of SDA, a function of equal increases in peak VO(2) and duration. For nine meal types of equivalent size (5% of body mass), the digestion of hard-bodied prey (crickets, superworms, mealworms, beetles) generated larger SDA responses than the digestion of soft-bodied prey (redworms, beetle larvae). Body temperature affected the profile of postprandial metabolism, increasing the peak and shortening the duration of the profile as body temperature increased. SDA was equivalent among three body temperatures (20 degrees, 25 degrees, and 30 degrees C) but decreased significantly at 15 degrees C. Comparatively, the postprandial metabolic responses and SDA of *Ambystoma jeffersonianum*, *Ambystoma maculatum*, *Ambystoma opacum*, *Ambystoma talpoideum*, *Ambystoma texanum*, and the conspecific *Ambystoma tigrinum mavortium* digesting cricket meals that were 5% of their body mass were

similar (independent of body mass) to those of *A. t. tigrinum*. Among the six species, standard metabolic rate, peak postprandial VO(2), and SDA scaled with body mass with mass exponents of 0.72, 0.78, and 1.05, respectively.
Descriptors: ambystomatid salamander, *Ambystoma tigrinum tigrinum*, body temperature, feeding behavior physiology, food, Urodela physiology, Annelida, Cyprinidae, energy metabolism physiology, Gryllidae, mice, Tenebrio, time factors.

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.

Secor, S.M. and A.C. Faulkner (2002). **Effects of meal size, meal type, body temperature, and body size on the specific dynamic action of the marine toad, *Bufo marinus*.** *Physiological and Biochemical Zoology* 75(6): 557-571. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Descriptors: amphibians, marine toad, *Bufo marinus*, size, body temperature, meal size, meal type, body size, effects.

Sundqvist, M. and S. Holmgren (2006). **Ontogeny of excitatory and inhibitory control of gastrointestinal motility in the African clawed frog, *Xenopus laevis*.** *American Journal of Physiology. Regulatory, Integrative and Comparative Physiology* 291(4): R1138-R1144. ISSN: print: 0363-6119; online: 1522-1490.
Online: http://dx.doi.org/10.1152/ajpregu.00107.2006
Abstract: The transparent body wall of *Xenopus laevis* larvae during the first developmental stages allows in vivo studies of gastrointestinal tract activity. The purpose of this study was to chart the ontogeny of gut motility in *Xenopus* larvae and to identify the most important control systems during the first developmental stages. Coordinated descending contraction waves first occurred in the gut at Nieuwkoop and Faber stage 43 [0.8 +/- 0.1 contractions/min (cpm)] and increased to 4.9 +/- 0.1 cpm at stage 47. The cholinergic receptor agonist carbachol (5-10 microM) increased contraction frequency already at stage 43, as did neurokinin A (NKA, 0.3-1 microM). The muscarinic antagonist atropine (100 microM) first affected contraction frequency at stage 45, which coincides with the onset of feeding. The tachykinin antagonist MEN-10,376 (6 microM) blocked NKA-induced contractions but not spontaneous motility. Both sodium nitroprusside [nitric oxide (NO) donor, 1-10 microM] and vasoactive intestinal peptide (VIP, 0.1-1 microM) inhibited contractions from the earliest stage onward. Blocking NO synthesis using NG-nitro-L-arginine methyl ester (100 microM) had no effect per se, but antagonized VIP evoked inhibition at stage 47. We conclude that gastrointestinal motility is well developed in the *Xenopus laevis* larvae before the onset of feeding. Functional muscarinic and tachykinin receptors are present already at the onset of motility, whereas a cholinergic tone develops around the onset of feeding. No endogenous tachykinin tone was found. Functional VIP receptors mediate inhibition at the onset of

motility. NO seems to mediate the VIP effect at later stages.
Descriptors: African clawed frog, *Xenopus laevis*, enteric nervous system, gastrointestinal motility, intestines innervation, atropine, carbachol, cholinergic agonists, enzyme inhibitors, neural inhibition, neurokinin a analogs and derivatives, nitric oxide donors, nitroprusside, vasoactive intestinal peptide.

Uchiyama, M. and N. Konno (2006). **Hormonal regulation of ion and water transport in anuran amphibians.** *General and Comparative Endocrinology* 147(1): 54-61. ISSN: 0016-6840.
NAL Call Number: 444.8 G28
Abstract: Amphibians occupy a wide variety of ecological habitats, and their adaptation is made possible through the specialization of the epithelia of their osmoregulatory organs, such as the skin, kidney, and urinary bladder, which control the hydromineral and acid-base balance of their internal medium. Amphibians can change drastically plasma Na+, Cl-, and urea levels and excretion rates in response to environmental stimuli such as acute desiccation and changes in external salinity. Several hormones and the autonomic nervous system act to control osmoregulation. Several ion channels including an epithelial sodium channel (ENaC), a urea transporter (UT), and water channels (AQPs) are found in epithelial tissues of their osmoregulatory organs. This mini review examines the currents status of our knowledge about hormone receptors for arginine vasotocin, angiotensin II and aldosterone, and membrane ion channels and transporters, such as ENaC, UT, and AQPs in amphibians.
Descriptors: amphibians, aldosterone metabolism, angiotensin II metabolism , anura physiology, ion transport physiology, vasotocin metabolism, water electrolyte balance physiology, kidney metabolism, receptors, peptide metabolism, skin physiology, urinary bladder metabolism.

Van Sluys, M., G.M. Schittini, R.V. Marra, A.R.M. Azevedo, J.J. Vicente, and D. Vrcebradic (2006). **Body size, diet and endoparasites of the microhylid frog *Chiasmocleis capixaba* in an Atlantic forest area of southern Bahia state, Brazil.** *Brazilian Journal of Biology* 66(1A): 167-173. ISSN: 1519-6984.
Descriptors: frog, *Chiasmocleis capixaba*, diet, body size, endoparasites, Brazil.
Language of Text: English; Portuguese.

Wang, T., J.B. Andersen and J.W. Hicks (2005). **Effects of digestion on the respiratory and cardiovascular physiology of amphibians and reptiles.** In: J.M. Starck and T. Wang (Editors), *Physiological and Ecological Adaptations to Feeding in Vertebrates.,* Science Publishers, Inc.: Enfield, NH, p. 279-303. ISBN: 1578082463.
NAL Call Number: QP145 .P46 2005
Descriptors: amphibians, reptiles, digestion, effect, respiratory physiology, cardiovascular physiology.

Whiles, M.R., J.B. Jensen, J.G. Palis, and W.G. Dyer (2004). **Diets of larval flatwoods salamanders, *Ambystoma cingulatum*, from Florida and South Carolina**. *Journal of Herpetology* 38(2): 208-214. ISSN: 0022-1511.
NAL Call Number: QL640.J6

Descriptors: amphibians, salamander, *Ambystoma cingulatum*, diet, larvae, fresh water crustaceans, isopods, copepods, cladocerans, amphipods, South Carolina, Florida, USA.

Diseases

Annis, S.L., F.P. Dastoor, H. Ziel, P. Daszak, and J.E. Longcore (2004). **A DNA-based assay identifies *Batrachochytrium dendrobatidis* in amphibians.** *Journal of Wildlife Diseases* 40(3): 420-428. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: amphibians, fungal pathogen, detection, DNA based assay, diagnostic techniques, fungal diseases, *Batrachochytrium dendrobatidis*.

Berger, L., R. Speare, H.B. Hines, G. Marantelli, A.D. Hyatt, K.R. McDonald, L.F. Skerratt, V. Olsen, J.M. Clarke, G. Gillespie, M. Mahony, N. Sheppard, C. Williams, and M.J. Tyler (2004). **Effect of season and temperature on mortality in amphibians due to chytridiomycosis.** *Australian Veterinary Journal* 82(7): 434-439. ISSN: 0005-0423.
NAL Call Number: 41.8 Au72
Descriptors: amphibians, anura, fungal diseases, chytridiomycosis, season and temperature, effects on mortality, season, temperature, Australia.

Bertelsen, M. and G. Crawshaw (2003). **5-Minute guide to amphibian disease**. *Exotic DVM* 5(2): 23-26. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: amphibians, diseases, guide, diagnosis, verterinary resource.

Blumer, C., D.R. Zimmermann, R. Weilenmann, L. Vaughan, and A. Pospischil (2007). **Chlamydiae in free-ranging and captive frogs in Switzerland.** *Veterinary Pathology* 44(2): 144-150. ISSN: 0300-9858.
Online: http://www.vetpathology.org/cgi/content/abstract/44/2/144
NAL Call Number: 41.8 P27
Abstract: A total of 210 frog samples originating either from a mass mortality (1991/1992) or from routine postmortem investigations of the years 1990 to 2004 were examined retrospectively for a possible involvement of Chlamydiae. For a prevalence study of Chlamydia in a selected Swiss amphibian population, 403 samples from free-ranging *Rana temporaria* were examined. Histopathology, immunohistochemistry using a monoclonal antibody against chlamydial lipopolysaccharide, and a 16S rRNA polymerase chain reaction (PCR) followed by DNA sequencing were performed on the formalin-fixed and paraffin-embedded tissues. Using PCR, 8 of 54 (14.8%) frog samples from the mass mortality (1991/1992) were positive for *Chlamydia suis* S45. A control group of healthy *Xenopus laevis* had 3 of 38 positive samples, sequenced as *C suis* S45 (2/3) and an endosymbiont of Acanthamoeba species UWE1 (1/3). *Chlamydophila pneumoniae* TW-183 was detected from exotic frogs kept in a zoo. Of the frogs collected for the prevalence study, 6 of 238 (2.5%) tested positive, 1 each for *C suis* S45, *Cp pneumoniae* TW-183, and uncultured Chlamydiales CRG22, and the remaining 3 revealed *Chlamydophila abortus* S26/3. In immunohistochemistry, there were 2 positive labeling reactions, 1 in intestine and the other in the epithelium coating the body

cavity, both testing positive for *Cp pneumoniae* TW-183 in PCR. Histologically there were no lesions recorded being characteristic for *Chlamydia*: Although there is a prevalence of *Chlamydia* in Swiss frogs, no connection to a mass mortality (1991/1992) could be established. For the first time, *C suis* S45 and *Cp abortus* S26/3 were detected in frog material.
Descriptors: frog, free ranging, captive, *Chlamydia*, mass mortality, postmortem, prevalence, Switzerland.

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.*

Boyle, D.G., D.B. Boyle, V. Olsen, J.A.T. Morgan, and A.D. Hyatt (2004). **Rapid quantitative detection of chytridiomycosis (*Batrachochytrium dendrobatis*) in amphibian samples using real-time Taqman PCR assay.** *Diseases of Aquatic Organisms* 60(2): 141-148. ISSN: 0177-5103.
Online: http://dx.doi.org/10.3354/dao060141
Descriptors: amphibians, anura , diagnostic techniques, *Batrachochytrium dendrobatis* (fungus), detection using pcr Taqman assay, fungal diseases.

Bradley, G.A., P.C. Rosen, M.J. Sredl, T.R. Jones, and J.E. Longcore (2002). **Chytridiomycosis in native Arizona frogs**. *Journal of Wildlife Diseases* 38(1): 206-212. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: *Rana*, frogs, chytridiomycosis, infection, fungus infection, reddening of skin, abdomen, pelvic area, legs, hyperkeratosis, sporangia.

Briggs, C.J., V.T. Vredenburg, R.A. Knapp, and L.J. Rachowicz (2005). **Investigating the population-level effects of chytridiomycosis: An emerging infectious disease of amphibians.** *Ecology* 86(12): 3149-3159. ISSN: 0012-9658.
Descriptors: *Rana*, frogs, animal pathogenic fungi, mycoses, population density, mortality, mathematical models, Batrachochytrium dendrobatids, *Rana muscosa*, California.
Notes: In the special section: Empirically motivated ecological theory / edited by A.R. Ives and A.A. Agrawal. Includes references.

Briggs, C. and S. Burgin (2003). **A rapid technique to detect chytrid infection in adult frogs.** *Herpetological Review* 34(2): 124-126. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: *Limnodynastes tasmaniensis*, *Litoria peronii*, diagnostic techniques, rapid detection, procedures, fungal disease.

Brunner, J.L., D.M. Schock, J.P. Collins, and E.W. Davidson (2002). **Persistence of a lethal ranavirus in a seasonally abundant salamander host**. *Ecological Society of America Annual Meeting Abstracts* 87: 88.
Descriptors: amphibians, salamander, ranavirus, persistance, lethal, abundant host, meeting.
Notes: Meeting Information: 87th Annual Meeting of the Ecological Society of America and the 14th Annual International Conference of the Society for Ecological Restoration, Tucson, Arizona, USA; August 4-9, 2002.

Cecil, T.R. (2006). **Amphibian renal disease.** *Veterinary Clinics of North America, Exotic Animal Practice* 9(1): 175-188. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Amphibians by nature have an intimate connection with the aquatic environment at some stage of development and fight an osmotic battle due to the influx of water. Many amphibians have acquired a more terrestrial existence at later stages of development and consequently have physiologic adaptations to conserve moisture. Renal adaptations have allowed amphibians successfully to bridge the gap between aqueous and terrestrial habitats. The kidneys, skin,and, in many amphibian species, the urinary bladder play key roles in fluid homeostasis. Renal impairment may be responsible for the clinical manifestation of disease, morbidity, and mortality.
Descriptors: amphibians, kidneys, kidney diseases, physiological adaptation, parasitology, species specificity.

Chai, N., L. Deforges, W. Sougakoff, C. Truffot Pernot, A. De Luze, B. Demeneix, M. Clement, and M.C. Bomsel (2006). ***Mycobacterium szulgai* infection in a captive population of African clawed frogs (*Xenopus tropicalis*).** *Journal of Zoo and Wildlife Medicine* 37(1): 55-58. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: amphibians, frogs, *Xenopus tropicalis*, *Mycobacterium szulgai*, infection, captive population.

Collins, J.P., J.L. Brunner, J.K. Jancovich, and D.M. Schock (2004). **A model host-pathogen system for studying infectious disease dynamics in amphibians: tiger salamanders (*Ambystoma tigrinum*) and *Ambystoma tigrinum* virus.** *Herpetological Journal* 14(4): 195-200. ISSN: 0268-0130.
Descriptors: amphibians, tiger salamanders, *Ambystoma tigrinum*, model host pathogen system, studying infectious disease, dynamics, virus.

Cunningham, A.A., T.W.J. Garner, V. Aguilar Sanchez, B. Banks, J. Foster, A.W. Sainsbury, M. Perkins, S.F. Walker, A.D. Hyatt, and M.C. Fisher (2005). **Emergence of amphibian chytridiomycosis in Britain.** *Veterinary Record* 157(13): 386-387. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: amphibians, mycoses, chytridiomycosis, diseases, Great Britain.

Daszak, P., A. Strieby, A.A. Cunningham, J.E. Longcore, C.C. Brown, and D. Porter (2004). **Experimental evidence that the bullfrog (*Rana catesbeiana*) is a potential carrier of chytridiomycosis, an emerging fungal disease of amphibians.** *Herpetological Journal* 14(4): 201-207. ISSN: 0268-0130.
Descriptors: amphibians, bullfrog, *Rana catesbeiana*, chytridiomycosis, potential carrier, fungal disease.

Daszak, P., A.A. Cunningham, and A.D. Hyatt (2003). **Infectious disease and amphibian population declines.** *Diversity and Distributions* 9(2): 141-150. ISSN: 1366-9516.
NAL Call Number: QH75.A1B573
Descriptors: amphibians, population declines, infectious disease, diseases and disorders, fungal diseases.

Davidson, E.W., M. Parris, J.P. Collins, J.E. Longcore, A.P. Pessier, and J. Brunner (2003). **Pathogenicity and transmission of chytridiomycosis in tiger salamanders (*Ambystoma tigrinum*).** *Copeia* 2003(3): 601-607. ISSN: 0045-8511.
Descriptors: tiger salamanders, *Ambystoma tigrinum*, fungal diseases, *Batrachochytrium dendrobatidis*, pathogenicity, transmission.

Davison, A.J., C. Cunningham, W. Sauerbier, and R.G. Mckinnell (2006). **Genome sequences of two frog herpesviruses**. *Journal of General Virology* 87(Part 12): 3509-3514. ISSN: 0022-1317.
Online: http://dx.doi.org/10.1099/vir.0.82291-0
NAL Call Number: QR360.A1J6
Descriptors: amphibians, herpesviruses, genome sequences, ranid herpesevirus 1, ranid herpesvirus 2, DNA, sequences.

Docherty, D.E., C.U. Meteyer, J. Wang, J. Mao, S.T. Case, and V.G. Chinchar (2003). **Diagnostic and molecular evaluation of three iridovirus-associated salamander mortality events.** *Journal of Wildlife Diseases* 39(3): 556-566. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: salamander, *Ambystoma maculatum*, *Ambystoma tigrinum diaboli*, *Ambystoma tigrinum melanostictum*, viral diseases, iridoviruses, associated mortality events, diagnostic, molecular, evaluation, mortality.

Drancourt, M., V. Jarlier, and D. Raoult (2002). **The environmental pathogen *mycobacterium ulcerans* grows in amphibian cells at low temperatures.** *Applied and Environmental Microbiology* 68(12): 6403-6404. ISSN: print: 0099-2240; online: 1098-5336.
Online: http://dx.doi.org/10.1128/AEM.68.12.6403-6404.2002
NAL Call Number: 448.3 Ap5
Descriptors: amphibians, amphibian cells, pathogen, *Mycobacterium ulcerans*, grows, low temperatures.

Ells, T.v., J. Stanton, A. Strieby, P. Daszak, A.D. Hyatt, and C. Brown (2003). **Use of immunohistochemistry to diagnose chytridiomycosis in dying poison dart frogs (*Dendrobates tinctorius*).** *Journal of Wildlife Diseases* 39(3): 742-745. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: poison dart frogs, *Dendrobates tinctorius*, Anura, dermatomycoses, Chytridiales, disease, diagnosis, *Batrachochytrium dendrobatis*.

Feldman, S.H., J.H. Wimsatt, and D.E. Green (2005). **Phylogenetic classification of the frog pathogen *Amphibiothecum* (Dermosporidium) *penneri* based on small ribosomal subunit sequencing.** *Journal of Wildlife Diseases* 41(4): 701-706. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: amphibians, frog, *Amphibiothecum penneri*, pathogen, phylogenetic classification, small ribosomal subunit sequencing.

Green, D.E. and K.A. Converse (2005). **Diseases of frogs and toads.** In: S.K. Majumdar, J.E. Huffman, F.J. Brenner and A.I. Panah (Editors), *Wildlife Diseases: Landscape Epidemiology, Spatial Distribution and Utilization of Remote Sensing Technology:* Pennsylvania Academy of Science: Easton, p. 89-117. ISBN: 0945809190.
Descriptors: frogs, toads, diseases, pathogens, epidemiology.

Green, D.E. and K.A. Converse (2005). **Disease of amphibian eggs and embryos.** In: S.K.H.J.E.B.F.J.P.A.I. Majumdar (Editors), *Wildlife Diseases: Landscape Epidemiology, Spatial Distribution and Utilization of Remote Sensing Technology:* Pennsylvania Academy of Science: Easton, p. 62-71. ISBN: 0945809190.
Descriptors: amphibians, diseases, eggs, embryos, pathogens, epidemiology.

Green, S.L., D.M. Bouley, C.A. Josling, and R. Fayer (2003). **Cryptosporidiosis associated with emaciation and proliferative gastritis in a laboratory-reared South African clawed frog (*Xenopus laevis*).** *Comparative Medicine* 53(1): 81-84. ISSN: 1532-0820.
NAL Call Number: SF77.C65
Abstract: A 2-year-old emaciated female South African clawed frog (*Xenopus laevis*) was euthanized because of chronic weight loss. At necropsy, there was no evidence of bacterial, fungal or viral disease; however, the histopathologic findings indicated a proliferative gastritis and the presence of numerous cryptosporidial stages throughout the intestinal tract. Cryptosporidial oocysts were present in the water taken from the aquarium housing the infected frog and were likely shed by the sick frog; however, the exact source of the oocysts could not be identified. Water samples from other frog aquaria in the facility did not contain cryptosporidial oocysts. Some *Cryptosporidium* species are important zoonotic pathogens and, to our knowledge, this is the first report of disease associated with *Cryptosporidium* infection in a laboratory *Xenopus laevis*.
Descriptors: clawed frog, *Xenopus laevis*, laboratory animals, cryptosporidiosis, *Cryptosporidium*, body condition, zoonoses, trophozoites, schizonts, oocysts, case studies, postmortem examinations.

Harkewicz, K., A.P. Pessier, L.A. Rollins Smith, R. Speare, and C. Weldon (2005). **Amphibian chytridiomycosis.** *Journal of Herpetological Medicine and Surgery* 15(3): 32-44. ISSN: 1529-9651.
NAL Call Number: SF997.5.R4 B85
Descriptors: amphibians, fungal disease, chytridiomycosis, treatment techniques, transmission, diagnosis.

Harp, E.M. and J.W. Petranka (2006). **Ranavirus in wood frogs (*Rana sylvatica*): potential sources of transmission within and between ponds.** *Journal of Wildlife Diseases* 42(2): 307-318. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: wood frogs, *Rana sylvatica*, viral diseases, ranavirus, potential sources, transmission, between ponds.

Harris, R.N., T.Y. James, A. Lauer, M.A. Simon, and A. Patel (2006). **Amphibian pathogen *Batrachochytrium dendrobatidis* is inhibited by the cutaneous bacteria of amphibian species.** *EcoHealth* 3(1): 53-56. ISSN: print: 1612-9202; online: 1612-9210.
Descriptors: amphibians, pathogen, *Batrachochytrium dendrobatidis*, inhibited, cutaneous bacteria, fungal.

Hassl, A. and G. Benyr (2003). **Hygienic evaluation of terraria inhabited by amphibians and reptiles: Cryptosporidia, free-living amebas, *Salmonella*.** *Wiener Klinische Wochenschrift* 115(Suppl.3): 68-71. ISSN: 0043-5325.
Descriptors: amphibians, reptiles, hygenic evaluation, Cryptosporidia, amebas, *Salmonella*, pets, disease transmission, vivarium, infectious diseases.
Language of Text: German.
Notes: Meeting Information: Vortrage der 36. jahrestagung der Osterreichischen Gesellschaft fur Tropenmedizin und Parasitologie.

Herrera, R.A., M.M. Steciow, and G.S. Natale (2005). **Chytrid fungus parasitizing the wild amphibian *Leptodactylus ocellatus* (Anura: Leptodactylidae) in Argentina**. *Diseases of Aquatic Organisms* 64(3): 247-252. ISSN: print: 0177-5103; online: 1616-1580.
Online: http://dx.doi.org/10.3354/dao064247
Descriptors: amphibian, *Leptodactylus ocellatus*, diseases, fungal disease, Chytrid fungus, wild amphibians, parasitizing, Argentina.

Holland, M.P., D.K. Skelly, M. Kashgarian, S.R. Bolden, L.M. Harrison, and M. Cappello (2007). **Echinostome infection in green frogs (*Rana clamitans*) is stage and age dependent**. *Journal of Zoology* 271(4): 455-462. ISSN: 0952-8369.
Descriptors: amphibians, green frogs, *Rana clamitans*, echinostome, infection, stage and age dependent, emerging infectious diseases, renal function, tadpoles.

Huys, G., M. Pearson, P. Kaempfer, R. Denys, M. Cnockaert, V. Inglis, and J. Swings (2003). ***Aeromonas hydrophila* subsp. Ranae subsp. nov., isolated from septicaemic farmed frogs in Thailand.** *International Journal of Systematic and Evolutionary Microbiology* 53(3): 885-891.

ISSN: 1466-5026.
Descriptors: farmed frogs, Rana, *Aeromonas hydrophila ranae*, septicemic, Thailand.

James, T.Y. and R. Vilgalys (2006). **Amphibian chytridiomycosis as an emerging infectious disease of wildlife: what can we learn from the earliest diverging fungi?** In: *Molecular Principles of Fungal Pathogenesis.,* American Society of Microbiology: Washington, DC, p. 271-278. ISBN: 1555813682.
Descriptors: amphibians, chytridiomycosis, fungal disease, epidemiology, etiology, emerging infectious disease, book chapter.

Jancovich, J.K., E.W. Davidson, N. Parameswaran, J. Mao, V.G. Chinchar, J.P. Collins, B.L. Jacobs, and A. Storfer (2005). **Evidence for emergence of an amphibian iridoviral disease because of human-enhanced spread**. *Molecular Ecology* 14(1): 213-224. ISSN: 0962-1083.
NAL Call Number: QH540.M64
Descriptors: amphibians, salamanders, infectious diseases, iridoviruses, pathogen, emerging diseases, epizootics, ranaviruses.

Johnson, A.J. and J.F.X. Wellehan (2005). **Amphibian virology.** *Veterinary Clinics of North America, Exotic Animal Practice* 8(1): 53-65. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Descriptors: amphibian virology, virology, veterinary clinics, review, viral diseases.

Johnson, M.L. and R. Speare (2005). **Possible modes of dissemination of the amphibian chytrid *Batrachochytrium dendrobatidis* in the environment**. *Diseases of Aquatic Organisms* 65(3): 181-186. ISSN: 0177-5103.
Online: http://dx.doi.org/10.3354/dao065181
Descriptors: amphibians, frogs, diseases, chytridiomycosis, bird feathers, dissemination, *B. dendrobatidis*, possible modes, river sand, environment.

Johnson, M.L., L. Berger, L. Philips, and R. Speare (2003). **Fungicidal effects of chemical disinfectants, UV light, desiccation and heat on the amphibian chytrid *Batrachochytrium dendrobatidis*.** *Diseases of Aquatic Organisms* 57(3): 255-260. ISSN: 0177-5103.
Online: http://dx.doi.org/10.3354/dao057255
Descriptors: amphibians, diseases, chemical disinfectants, UV light, desiccation, heat, fungicidal effects, chytrid, *Batrachochytrium dendrobatidis*, fungal disease.

Johnson, P.T. (2006). **Amphibian diversity: decimation by disease.** *Proceedings of the National Academy of Sciences of the United States of America* 103(9): 3011-3012. ISSN: print: 0027-8424; online: 1091-6490.
NAL Call Number: 500 N21P
Descriptors: amphibia, animal diseases epidemiology, biodiversity, communicable diseases veterinary, communicable diseases epidemiology.
Notes: Comment On: Proc Natl Acad Sci U S A. 2006 Feb 28;103(9):3165-70.

Johnson, P.T.J. and J.M. Chase (2004). **Parasites in the food web: Linking amphibian malformations and aquatic eutrophication**. *Ecology Letters* 7(7): 521-526. ISSN: 1461-023X.
NAL Call Number: QH540.E262
Descriptors: amphibians, aquatic animals, parasites, food web, malformations, emerging diseases, *Ribeiroia ondatrae*, aquatic eutrophication.

Johnson, P.T., K.B. Lunde, D.A. Zelmer, and K. Werner (2003). **Amphibian malformations and parasite infection: an emerging disease?** *Ecological Society of America Annual Meeting Abstracts* 88: 171. ISSN: 0012-9623.
Descriptors: amphibians, malformations, parasite infection, emerging disease, meeting.
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.

Juopperi, T., K. Karli, R. De Voe, and C.B. Grindem (2002). **Granulomatous dermatitis in a spadefoot toad (*Scaphiopus holbrooki*).** *Veterinary Clinical Pathology* 31(3): 137-139. ISSN: 0275-6382.
NAL Call Number: SF601.A54
Descriptors: toad, dermatitis, symptoms, duration, body condition, biopsy, fungi, case studies, fungal diseases of plants, clinical aspects, lesions.

Klenk, K. and N. Komar (2003). **Poor replication of West Nile virus (New York 1999 strain) in three reptilian and one amphibian species.** *American Journal of Tropical Medicine and Hygiene* 69(3): 260-262. ISSN: 0002-9637.
Online: http://www.ajtmh.org/cgi/content/abstract/69/3/260?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&author1=klenk%2C+k&fulltext=west+nile&searchid=1&FIRSTINDEX=0&sortspec=relevance&resourcetype=HWCIT
Descriptors: West Nile virus, NY 1999 strain, poor replication, three reptilian species, one amphibian species.

Knapp, R.A. and J.A.T. Morgan (2006). **Tadpole mouthpart depigmentation as an accurate indicator of chytridiomycosis, an emerging disease of amphibians.** *Copeia* 2006(2): 188-197. ISSN: 0045-8511.
Descriptors: amphibians, emerging diseases, tadpole mouthpart depigmentation as accurate indicator of fungal disease, chytridiomycosis.

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.

Kriger, K.M. and J.M. Hero (2006). **Survivorship in wild frogs infected with chytridiomycosis**. *EcoHealth* 3(3): 171-177. ISSN: print: 1612-9202; online: 1612-9210.
Descriptors: amphibians, wild frogs, chytridiomycosis, infectious disease, survivorship, emerging infectious diseases.

Kriger, K.M., H.B. Hines, A.D. Hyatt, D.G. Boyle, and J.M. Hero (2006). **Techniques for detecting chytridiomycosis in wild frogs: Comparing histology with real-time taqman pcr**. *Diseases of Aquatic Organisms* 71(2): 141-148. ISSN: 0177-5103.
Online: http://dx.doi.org/10.3354/dao071141
Descriptors: amphibians, wild frogs, chytridiomycosis, detecting techniques, PCR assay, rapid, noninvasive, swab PCR.

Kuroki, T. and Y. Une (2007). **Chytridiomycosis in amphibians**. *Bulletin of the Herpetological Society of Japan*(1): 20-31. ISSN: 1345-5826.
Descriptors: amphibians, frogs, fungal disease, infection, emerging infectious diseases, Chytridiomycosis.
Language of Text: Japanese.

Lane, E.P., C. Weldon, and J. Bingham (2003). **Histological evidence of chytridiomycete fungal infection in a free-ranging amphibian, *Afrana fuscigula* (Anura: Ranidae), in South Africa**. *Journal of the South African Veterinary Association* 74(1): 20-21. ISSN: 0038-2809.
NAL Call Number: 41.8 So8
Descriptors: amphibians, fungal infection, chytridiomycosis, histological evidence, frogs, dermatitis, Anura, Ranidae, free ranging, South Africa.

Lips, K.R., F. Brem, R. Brenes, J.D. Reeve, R.A. Alford, J. Voyles, C. Carey, L. Livo, A.P. Pessier, and J.P. Collins (2006). **Emerging infectious disease and the loss of biodiversity in a Neotropical amphibian community.** *Proceedings of the National Academy of Sciences of the United States of America* 103(9): 3165-3170. ISSN: print: 0027-8424; online: 1091-6490.
NAL Call Number: 500 N21P
Abstract: Pathogens rarely cause extinctions of host species, and there are few examples of a pathogen changing species richness and diversity of an ecological community by causing local extinctions across a wide range of species. We report the link between the rapid appearance of a pathogenic chytrid fungus *Batrachochytrium dendrobatidis* in an amphibian community at El Cope, Panama, and subsequent mass mortality and loss of amphibian biodiversity across eight families of frogs and salamanders. We describe an outbreak of chytridiomycosis in Panama and argue that this infectious disease has played an important role in amphibian population declines. The high virulence and large number of potential hosts of this emerging infectious disease threaten global amphibian diversity.
Descriptors: amphibia physiology, animal diseases epidemiology, biodiversity, communicable diseases, emerging veterinary, tropical climate, communicable diseases, emerging epidemiology, models, biological, mycoses epidemiology, mycoses veterinary, Panama epidemiology, population dynamics, time factors.
Notes: Comment In: Proc Natl Acad Sci U S A. 2006 Feb 28;103(9):3011-2.

Lips, K.R., D.E. Green, and R. Papendick (2003). **Chytridiomycosis in wild frogs from southern Costa Rica.** *Journal of Herpetology* 37(1): 215-218. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: amphibians, diseases, fungal disease, wild frogs, chytridiomycosis, Costa Rica.

Maclean, B. (2006). **Common dermatoses of ornamental fish and amphibians.** *In Practice* 28(10): 604-613. ISSN: 0263-841X.
Descriptors: ornamental fish, amphibians, skin diseases, skin lesions , signs, symptoms (animals and humans), animal pathogens, disease diagnosis, clinical examination, medical treatment.

Manskikh, V.N. (2003). **Skin tumor in toad (*Bufo bufo*).** *Voprosy Onkologii* 49(3374-3375) ISSN: 0507-3758.
Descriptors: amphibians, toad, Bufo, tumor, skin, neoplasia.
Language of Text: Russian.

Mazzoni, R., A.A. Cunningham, P. Daszak, A. Apolo, E. Perdomo, and G. Speranza (2003). **Emerging pathogen of wild amphibians in frogs (*Rana catesbeiana*) farmed for international trade.** *Emerging Infectious Diseases* 9(8): 995-998. ISSN: print: 1080-6040; online: 1080-6059.
NAL Call Number: RA648.5.E46
Descriptors: amphibians, frogs, *Rana catesbeiana*, farmed, international trade, emerging pathogen, chytridiomycosis, infectious disease.

Miller, D.L., S. Rajeev, M.J. Gray, and C.A. Baldwin (2007). **Frog virus 3 infection, cultured American bullfrogs.** *Emerging Infectious Diseases* 13(2): 342-343. ISSN: print: 1080-6040; online: 1080-6059.
NAL Call Number: RA648.5.E46
Descriptors: amphibians, frog, virus 3 infection, cultured bullfrogs, diseases, infection.

Monks, D.J., M.S. Carlisle, M. Carrigan, K. Rose, D. Spratt, A. Gallagher, and P. Prociv (2005). ***Angiostrongylus cantonensis* as a cause of cerebrospinal disease in a yellow-tailed black cockatoo (*Calyptorhynchus funereus*) and two tawny frogmouths (*Podargus strigoides*).** *Journal of Avian Medicine and Surgery* 19(4): 289-293. ISSN: 1082-6742.
NAL Call Number: SF994.J6
Descriptors: amphibians, *Angiostrongylus cantonensis*, cockatoo, *Calyptorhynchus funereus*, tawny frogmouths, *Podargus strigoides*, cerebrospinal disease, Australia.

Morehouse, E.A., T.Y. James, A.R. Ganley, R. Vilgalys, L. Berger, P.J. Murphy, and J.E. Longcore (2003). **Multilocus sequence typing suggests the chytrid pathogen of amphibians is a recently emerged clone.** *Molecular Ecology* 12(2): 395-403. ISSN: 0962-1083.
NAL Call Number: QH540.M64
Abstract: Chytridiomycosis is a recently identified fungal disease associated with global population declines of frogs. Although the fungus, *Batrachochytrium dendrobatidi*s, is considered an emerging pathogen, little is known about its population genetics, including the origin of the current epidemic and how this relates to the dispersal ability of the fungus. In this study, we use multilocus sequence typing to examine genetic diversity and relationships among 35 fungal strains from North America, Africa and Australia. Only five variable nucleotide positions were detected among 10 loci (5918 bp). This low level of genetic variation is

consistent with the description of *B. dendrobatidis* as a recently emerged disease agent. Fixed (i.e. 100%) or nearly fixed frequencies of heterozygous genotypes at two loci suggested that *B. dendrobatidis* is diploid and primarily reproduces clonally. In contrast to the lack of nucleotide polymorphism, electrophoretic karyotyping of multiple strains demonstrated a number of chromosome length polymorphisms.
Descriptors: amphibians, chytrid pathogen, sequence typing, recently emerged clone, fungal disease, population genetics.

Mutschmann, F. (2004). **Pathological changes in African hyperoliid frogs due to a myxosporidian infection with a new species of Hoferellus (Myxozoa).** *Diseases of Aquatic Organisms* 60(3): 215-222. ISSN: print: 0177-5103; online: 1616-1580.
Online: http://dx.doi.org/10.3354/dao060215
Abstract: A proliferous, polycystic and sometimes fatal kidney disease due to an infection with myxosporidia is reported in 24 of 28 hyperoliid frogs (*Afrixalus dorsalis*, *Hyperolius concolor*, Hyperolius sp.) from Nigeria, Ghana and Tanzania. In line with pathological changes in fish, the disease is described as 'frog kidney enlargement disease' (FKED). *Myxosporidian plasmodi*a, different developmental stages and spores occurred in the kidney, ureter, and urinary bladder and in the intestine of the frogs. The parasite belongs to the genus Hoferellus and is presented as a new species: *H. anurae n*. sp. Spores are similar in size and structure to other Hoferellus species in fish but differ by the presence of a more prominent suture line and shorter caudal appendages. This is the first report on a Hoferellus species in amphibians as well as the first report of the genus Hoferellus in African vertebrates.
Descriptors: frogs, pathological changes, infection , myxosporidian, new species, Hoferellus, fatal kidney disease, ureter, urinary bladder, intestine, parasite.

Mylniczenko, N.D. (2006). **A medical health survey of diseases in captive caecilian amphibians**. *Journal of Herpetological Medicine and Surgery* 16(4): 120-128. ISSN: 1529-9651.
Online: http://www.arav.org/Journals/J053TI.htm
NAL Call Number: SF997.5.R4 B85
Descriptors: amphibians, diseases, survey, captive, fecal examintions, antemortem, postmortem, examination, therapy, antibiotics, treatments, medical care, microbial cultures, septicemia.

Olsen, V., A.D. Hyatt, D.G. Boyle, and D. Mendez (2004). **Co-localisation of *Batrachochytrium dendrobatidis* and keratin for enhanced diagnosis of chytridiomycosis in frogs.** *Diseases of Aquatic Organisms* 61(1-2): 85-88 . ISSN: print: 0177-5103; online: 1616-1586.
Online: http://dx.doi.org/10.3354/dao061085
Abstract: Chytridiomycosis is a disease of post-metamorphic frogs caused by the fungus *Batrachochytrium dendrobatidis* and is associated with large declines in frog populations on a global scale. *B. dendrobatidis* is found only in the keratinised tissues, which include the mouthparts of healthy tadpoles. The epidermis of infected post-metamorphic frogs is thickened (hyperkeratosis) and the superficial layer can sometimes slough. Diagnosis is most commonly performed on stained sections of toe clips or ventral skin. Accurate interpretation can be difficult and requires a high level of expertise, particularly in infected animals

exhibiting hyperkeratosis with sloughing. Misdiagnosis can occur when zoosporangia of *B. dendrobatidis* are shed with the superficial keratin layers. We have developed a staining protocol based on previously described methods to detect both *B. dendrobatidis* and keratin, to improve the sensitivity and specificity of diagnosis of chytridiomycosis by inexperienced diagnosticians.
Descriptors: frogs, anurans, fungus, *Batrachochytrium dendrobatidis*, microbiology, chytridiomycota, mycoses, azo compounds, eosine yellowish eyes, immunohistochemistry, keratins, methyl green, mouth pathology.

Pare, J.A. (2003). **Fungal diseases of amphibians: an overview.** *Veterinary Clinics of North America, Exotic Animal Practice* 6(2): 315-326. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Descriptors: amphibians, fungal diseases, overview.

Parker, J.M., I. Mikaelian, N. Hahn, and H.E. Diggs (2002). **Clinical diagnosis and treatment of epidermal chytridiomycosis in African clawed frogs (*Xenopus tropicalis*).** *Comparative Medicine* 52(3): 265-268. ISSN: 1532-0820.
NAL Call Number: SF77.C65
Abstract: An investigation was conducted to determine the cause of morbidity and mortality in a collection of 55 adult male *Xenopus* (Silurana) tropicalis at the University of California, Berkeley. More than 80% of affected frogs died during the epizootic. All frogs were anorectic and lethargic, had dark pigmentation and excess skin sloughing, and lacked a slime layer. Histologic examination revealed severe hyperplastic and spongiotic dermatitis associated with colonization of the stratum corneum by large numbers of zoosporangia diagnostic of *Batrachochytrium dendrobatidis*. Treatment with a commercial formalin/malachite green solution at a dilution of 0.007 ml/L of tank water for 24 h, repeated every other day for four treatments, eliminated the organism and was curative. These findings are indicative of epidermal chytridiomycosis as a primary cause of death in this collection of *X. tropicalis.*
Descriptors: *Xenopus*, laboratory animals, mortality, Chytridiales, dermatomycoses, epidemiology, histopathology, case studies, Silurana tropicalis, *Batrachochytrium dendrobatidis.*

Parris, M.J. and T.O. Cornelius (2004). **Fungal pathogen causes competitive and developmental stress in larval amphibian communities.** *Ecology* 85(12): 3385-3395. ISSN: 0012-9658.
Descriptors: *Bufo*, *Hyla*, frogs, animal pathogenic fungi, mycoses, animal development, interspecific competition, mortality, *Bratrachochytrium dendrobatidis.*

Pasmans, F., P. Zwart, and A.D. Hyatt (2004). **Chytridiomycosis in the Central American bolitoglossine salamander (*Bolitoglossa dofleini*).** *Veterinary Record* 154(5): 153. ISSN: 0042-4900.
NAL Call Number: 41.8 V641
Descriptors: salamander, *Bolitoglossa dofleini*, disease, chytridiomycosis, fungus.

Pearl, C.A., E.L. Bull, D.E. Green, J. Bowerman, M.J. Adams, A. Hyatt, and W.H. Wente (2007). **Occurrence of the amphibian pathogen *Batrachochytrium dendrobatidis* in the Pacific northwest**. *Journal of Herpetology* 41(1): 145-149. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: amphibians, chytridiomycosis, fungal disease, infectious disease, Pacific nothwest, occurrence, pathogen, *Batrachochytrium dendrobatidis.*

Pereira, C.N., I. Di Rosa, A. Fagotti, F. Simoncelli, R. Pascolini, and L. Mendoza (2005). **The pathogen of frogs *Amphibiocystidium ranae* is a member of the order Dermocystida in the class Mesomycetozoea.** *Journal of Clinical Microbiology* 43(1): 192-198. ISSN: 0095-1137.
Online: http://dx.doi.org/10.1128/JCM.43.1.192-198.2005
NAL Call Number: QR46.J6
Abstract: The pathogen of frogs *Amphibiocystidium ranae* was recently described as a new genus. Due to its spherical shape, containing hundred of endospores, it was thought to be closely related to the pathogens of fish, mammals, and birds known as Dermocystidium spp., *Rhinosporidium seeberi*, and *Sphaerothecum destruens* in the Mesomycetozoea, but further studies were not conducted to confirm this relationship. To investigate its phylogenetic affinities, total genomic DNA was extracted from samples collected from infected frogs containing multiple cysts (sporangia) and endospores. The universal primers NS1 and NS8, used to amplify the 18S small-subunit rRNA by PCR, yielded [approximately]1,770-bp amplicons. Sequencing and basic local alignment search tool analyses indicated that the 18S small-subunit rRNA of *A. ranae* from both *Rana esculenta* and *Rana lessonae* was closely related to all of the above organisms. Our phylogenetic analysis placed this pathogen of frogs as the sister group to the genus Dermocystidium and closely related to RHINOSPORIDIUM: These data strongly supported the placement of the genus Amphibiocystidium within the mesomycetozoeans, which is in agreement with the phenotypic features that *A. ranae* shares with the other members of this class. Interestingly, during this study *Dermocystidium percae* did not group within the Dermocystidium spp. from fish; rather, it was found to be the sister group to *Sphaerothecum destruens*. This finding suggests that *D. percae* could well be a member of the genus Sphaerothecum or perhaps represents a new genus.
Descriptors: amphibians, frogs, *Amphibiocystidium ranae*, pathogens, endospores, Mesomycetozoea, Sphaerothecum.

Pessier, A.P. (2007). **Cytologic diagnosis of disease in amphibians.** *Veterinary Clinics of North America, Exotic Animal Practice* 10(1): 187-206. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Cytology is an inexpensive yet powerful diagnostic tool that allows for rapid diagnosis of many common disease conditions in amphibian patients. Although the emphasis of this article is on infectious diseases, there is great potential for application of cytologic diagnosis to variety of medical conditions as the knowledge base in amphibian medicine and pathology continues to grow. Routine methods used that may fall under the umbrella of cytology range from wet mount examination of skin scrapings (or gill biopsies of larvae) to examination of stained impression smears. Routine Romanowsky's-type stains work well for amphibian samples. Preparation of multiple smears is always recommended to allow for use

of special staining procedures.
Descriptors: amphibians, parasitology, cytodiagnosis, veterinary, skin diseases, animal diseases, pathology, body fluids, cytology, microbiology, parasitology.

Pessier, A.P. (2002). **An overview of amphibian skin disease.** *Seminars in Avian and Exotic Pet Medicine* 11(3): 162-174. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: amphibians, skin diseases, overview, parasites.

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.

Piotrowski, J.S., S.L. Annis, and J.E. Longcore (2004). **Physiology of *Batrachochytrium dendrobatidis*, a chytrid pathogen of amphibians.** *Mycologia* 96(1): 9-15. ISSN: 0027-5514.
NAL Call Number: 450 M99
Descriptors: Chytridiomycetes, animal pathogenic fungi, zoospores, proteinases, fungal proteins, protein synthesis, temperature, pH, culture media, Amphibia, *Batrachochytrium dendrobatidis.*

Rachowicz, L.J., R.A. Knapp, J.A.T. Morgan, M.J. Stice, V.T. Vredenburg, J.M. Parker, and C.J. Briggs (2006). **Emerging infectious disease as a proximate cause of amphibian mass mortality.** *Ecology* 87(7): 1671-1683. ISSN: 0012-9658.
Descriptors: mycoses, frogs, *Rana muscosa*, disease incidence, disease prevalence, population size, mortality, field experimentation, chytridiomycosis, *Batrachytrium dendrobatidis*, population loss, Sierra Nevada, California.

Rachowicz, L.J. and V.T. Vredenburg (2004). **Transmission of *Batrachochytrium dendrobatidis* within and between amphibian life stages.** *Diseases of Aquatic Organisms* 61(1-2): 75-83. ISSN: print: 0177-5103; online: 1616-1586.
Online: http://dx.doi.org/10.3354/dao061075
Abstract: Chytridiomycosis is an emerging infectious disease caused by the chytrid fungus *Batrachochytrium dendrobatidis*, which has been implicated in amphibian declines worldwide. The mountain yellow-legged frog *Rana muscosa* is a declining amphibian species that can be infected by *B. dendrobatidis*; however, transmission between conspecifics has not been documented. Here, we present experimental evidence that *R. muscosa* tadpoles can be infected by fungal zoospores and that they can transmit infection to each other and to postmetamorphic animals. We compared several techniques for detecting *B. dendrobatidis* transmission and found that histology with serial sectioning was able to detect infection before cytology or visual inspections. We also show that *R. muscosa* tadpoles appear healthy with *B. dendrobatidis* infection, while postmetamorphic animals experience mortality. In addition, we provide guidelines for visually detecting *B. dendrobatidis* in *R. muscosa* tadpoles, which may be useful in other affected species. Field surveys of infected and uninfected populations verify this identification technique.
Descriptors: amphibians, *Rana mucosa*, chytridiomycosis, transmission, life stages, fungus, *Batrachochytrium dendrobatidis*, tadpoles, infected, zoospores, detecting infection, icentification technique.

Raffel, T.R., J.R. Rohr, J.M. Kiesecker, and P.J. Hudson (2006). **Negative effects of changing temperature on amphibian immunity under field conditions**. *Functional Ecology* 20(5): 819-828. ISSN: 0269-8463.
NAL Call Number: QH540.F85
Descriptors: amphibians, immunity, changing temperature, negative effects, field conditions, seasonal acclimation, increased susceptibility.

Raffel, T.R., J.R. Dillard, and P.J. Hudson (2006). **Field evidence for leech-borne transmission of amphibian *Ichthyophonus* sp.** *Journal of Parasitology* 92(6): 1256-1264. ISSN: 0022-3395.
Descriptors: amphibians, infection, *Ichthyophonus* infection, leech borne, fungal disease, transmission.

Robinson, J., R.A. Griffiths, and P. Jeffries (2003). **Susceptibility of frog (*Rana temporaria*) and toad (*Bufo bufo*) eggs to invasion by saprolegnia.** *Amphibia Reptilia* 24(3): 261-268. ISSN: 0173-5373.
Descriptors: amphibians, frog, *Rana temporaria*, toad, *Bufo bufo*, invasion, infection, saprolegnia, susceptibility, zoospores, eggs.

Rojas, S., K. Richards, J.K. Jancovich, and E.W. Davidson (2005). **Influence of temperature on Ranavirus infection in larval salamanders *Ambystoma tigrinum*.** *Diseases of Aquatic Organisms* 63(2/3): 95-100. ISSN: print: 0177-5103; online: 1616-1580.
Online: http://dx.doi.org/10.3354/dao063095

Descriptors: amphibians, salamanders, *Ambystoma tigrinum*, ranavirus infection, larval, water temperature, influence, mortality.

Rollins Smith, L.A. and J.M. Conlon (2005). **Antimicrobial peptide defenses against chytridiomycosis, an emerging infectious disease of amphibian populations**. *Developmental and Comparative Immunology* 29(7): 589-598. ISSN: 0145-305X.
Descriptors: amphibians, antimicrobial peptides, defences, chytridiomycosis, skin, frogs , toads, fungus, *Batrachohytrium dendrobatidis*, infectious disease.

Rollins Smith, L.A., C. Carey, J. Longcore, J.K. Doersam, A. Boutte, J.E. Bruzgal, and J.M. Conlon (2002). **Activity of antimicrobial skin peptides from ranid frogs against *Batrachochytrium dendrobatidis* , the chytrid fungus associated with global amphibian declines.** *Developmental and Comparative Immunology* 26(5): 471-479. ISSN: 0145-305X.
Descriptors: amphibians, *Rana*, proteins, antimicrobial peptides, skin, fungal diseases, *Batrachochytrium dendrobatidis*, antimicrobial skin peptides effect on fungus, immune response.

Romansic, J.M., K.A. Diez, E.M. Higashi, and A.R. Blaustein (2006). **Effects of nitrate and the pathogenic water mold *Saprolegnia* on survival of amphibian larvae.** *Diseases of Aquatic Organisms* 68(3): 235-243. ISSN: 0177-5103.
Online: http://dx.doi.org/10.3354/dao068235
Descriptors: amphibian larvae, nitrate, pathogenic water, mold, *Saprolegnia* , effects, survival.

Ruthig, G.R. (2003). **The influence of infectious disease on amphibian egg-laying behavior.** *Ecological Society of America Annual Meeting Abstracts* 88: 293. ISSN: 0012-9623.
Descriptors: amphibians, egg laying behavior, infectious disease, influence, meeting.
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.

Schumacher, J. (2006). **Selected infectious diseases of wild reptiles and amphibians.** *Journal of Exotic Pet Medicine* 15(1): 18-24. ISSN: 1557-5063.
NAL Call Number: SF994.2.A1 S36
Descriptors: amphibians, reptiles, bacterial diseases, susceptibility, captive animals, wild population, fungal diseases, viral diseases.

Stacy, B.A. and J.M. Parker (2004). **Amphibian Oncology.** *Veterinary Clinics of North America, Exotic Animal Practice* 7(3): 673-695. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Spontaneous neoplasia is rare in all three orders of Amphibia.Tumors are documented in most major organ systems, and some have various underlying etiologies, including viral infection, environmental contaminants, and genetic predisposition. Currently,treatment options are limited to removal of the predisposing condition(s), palliative care, surgical excision, and, when necessary,humane euthanasia may be elected. Neoplasia must be dis-

tinguished from common infectious, nonneoplastic conditions that can negatively impact population health. This article is a review of the more common types of neoplasia in amphibians, and includes clinically relevant information, such as biologic behavior,anatomy, associated etiologies, major differential diagnoses, and clinical management.
Descriptors: amphibians, neoplasia, tumors, differential diagnosis, viral infection, anatomy, clinical management, surgical excision, palliative care.

Tanteidan, K. (2007). **A handbook of amphibian chytrid fungus disease in the field**. *Bulletin of the Herpetological Society of Japan*(1): 43-46. ISSN: 1345-5826.
Descriptors: amphibians, diseases, fungus disease, field, chytrid fungus disease, handbook.
Language of Text: Japanese.

Trott, K.A., B.A. Stacy, B.D. Lifland, H.E. Diggs, R.M. Harland, M.K. Khokha, T.C. Grammer, and J.M. Parker (2004). **Characterization of a *Mycobacterium ulcerans*-like infection in a colony of African tropical clawed frogs (*Xenopus tropicalis*).** *Comparative Medicine* 54(3): 309-317. ISSN: 1532-0820.
NAL Call Number: SF77.C65
Abstract: A nontuberculous *Mycobacterium ulcerans*-like organism was identified as the causative agent of an epizootic of mycobacteriosis in a colony of African tropical clawed frogs, *Xenopus (Silurana) tropicalis*, at the University of California, Berkeley. Diverse clinical signs of disease were observed, including lethargy, excess buoyancy, coelomic effusion, cutaneous ulcers, and granulomas. Visceral granulomas, ulcerative and granulomatous dermatitis, coelomitis, and septicemia were common findings at necropsy. Identification of *M. ulcerans*-like organisms was based on molecular and phenotypical characteristics. The findings of this investigation indicate that this *M. ulcerans*-like organism is a primary cause of morbidity and mortality in aquatic anurans and should be considered in the differential diagnosis of coelomic effusion in amphibians. Furthermore, if this Mycobacterium species ultimately is identified as *M. ulcerans*, *X. tropicalis* should be considered a potential source of this important public health pathogen.
Descriptors: amphibians, African tropicalclawed frogs, mycobacterium infections, atypical diagnosis, *Mycobacterium ulcerans* genetics, isolation, purification, *Xenopus* microbiology, liver microbiology, pathology, atypical pathology, differential diagnosis.

Webb, R., D. Mendez, L. Berger, and R. Speare (2007). **Additional disinfectants effective against the amphibian chytrid fungus *Batrachochytrium dendrobatidis.*** *Diseases of Aquatic Organisms* 74(1): 13-16. ISSN: print: 0177-5103; online: 1616-1580.
Online: http://dx.doi.org/10.3354/dao074013
Abstract: Chytridiomycosis, a disease contributing to amphibian declines worldwide, is caused by the fungus *Batrachochytrium dendrobatidis*. Identifying efficient and practical disinfectants effective against *B. dendrobatidis* is important to reduce the spread of the disease both in the wild and captivity. Previous studies identified a range of suitable disinfectant strategies. We evaluated the suitability of 3 additional disinfectants: two of these (TriGene Virucidal Disinfectant Cleaner and F10 Super Concentrate Disinfectant) are mixtures of chemicals and one (Betadine Antiseptic Liquid) contains a single active ingredient, povidone

iodine. The disinfectants were tested using a range of concentrations for 1,5 and 10 min to determine their ability to kill *B. dendrobatidis* in vitro. The measure of effectiveness was 100% kill of zoosporangia grown in multiwell plates. All disinfectants had a 100% efficacy at concentrations recommended by the manufacturers. The lowest concentrations capable of 100% kill after exposure for 1 min were 0.1 ml l(-1) for TriGene, 0.33 ml l(-1) for F10 and 100 ml l(-1) for Betadine. TriGene is the most effective disinfectant yet to be found, and both TriGene and F10 are more effective than various disinfectants tested in previous studies. TriGene and F10 are considered suitable for use in the field, as only small amounts of concentrate are needed.

Descriptors: decline of amphibians, chytrid fungus, *Batrachochytrium dendrobatidis*, effective disinfectants, chytridomycosis, disinfectant strategies, reduce spread, kill of zoosporangia, lowest concentrations, TriGene most effective.

Weldon, C., L.H. du Preez, A.D. Hyatt, R. Muller, and R. Spears (2004). **Origin of the amphibian chytrid fungus.** *Emerging Infectious Diseases* 10(12): 2100-2105. ISSN: print: 1080-6040; online: 1080-6059.

NAL Call Number: RA648.5.E46

Abstract: The sudden appearance of chytridiomycosis, the cause of amphibian deaths and population declines in several continents, suggests that its etiologic agent, the amphibian chytrid *Batrachochytrium dendrobatidis*, was introduced into the affected regions. However, the origin of this virulent pathogen is unknown. A survey was conducted of 697 archived specimens of 3 species of Xenopus collected from 1879 to 1999 in southern Africa in which the histologic features of the interdigital webbing were analyzed. The earliest case of chytridiomycosis found was in a *Xenopus laevis* frog in 1938, and overall prevalence was 2.7%. The prevalence showed no significant differences between species, regions, season, or time period. Chytridiomycosis was a stable endemic infection in southern Africa for 23 years before any positive specimen was found outside Africa. We propose that Africa is the origin of the amphibian chytrid and that the international trade in *X. laevis* that began in the mid-1930s was the means of dissemination.

Descriptors: amphibian, *Xenopus laevis*, chytrid fungus, chytridiomycosis, virulent pathogen, international trade, dissemination, southern Africa.

Weldon, C. and L.H. Du Preez (2006). **Quantitative measurement of *Batrachochytrium dendrobatidis* in amphibian skin**. *Diseases of Aquatic Organisms* 72(2): 153-161. ISSN: 0177-5103.

Online: http://dx.doi.org/10.3354/dao072153

Descriptors: amphibians, disease, skin, *Batrachytrium dendrobatidis*, quantitative measurement, pathological research, skin sloughs, examination.

Weng, S.P., J.G. He, X.H. Wang, L. Lu, M. Deng, and S.M. Chan (2002). **Outbreaks of an iridovirus disease in cultured tiger frog, *Rana tigrina rugulosa*, in southern China**. *Journal of Fish Diseases* 25(7): 423-427. ISSN: 0140-7775.

NAL Call Number: SH171.A1J68

Descriptors: amphibians, cultured tiger frog , *Rana tigina rugulosa*, indovirus disease, outbreak, China .

Woodhams, D.C., J. Voyles, K.R. Lips, C. Carey, and L.A. Rollins Smith (2006). **Predicted disease susceptibility in a Panamanian amphibian assemblage based on skin peptide defenses.** *Journal of Wildlife Diseases* 42(2): 207-218. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Abstract: Chytridiomycosis is an emerging infectious disease of amphibians caused by a chytrid fungus, *Batrachochytrium dendrobatidis*. This panzootic does not equally affect all amphibian species within an assemblage; some populations decline, others persist. Little is known about the factors that affect disease resistance. Differences in behavior, life history, biogeography, or immune function may impact survival. We found that an innate immune defense, antimicrobial skin peptides, varied significantly among species within a rainforest stream amphibian assemblage that has not been exposed to *B. dendrobatidis*. If exposed, all amphibian species at this central Panamanian site are at risk of population declines. In vitro pathogen growth inhibition by peptides from Panamanian species compared with species with known resistance (*Rana pipiens* and *Xenopus laevis*) or susceptibility (*Bufo boreas*) suggests that of the nine species examined, two species (*Centrolene prosoblepon* and *Phyllomedusa lemur*) may demonstrate strong resistance, and the other species will have a higher risk of disease-associated population declines. We found little variation among geographically distinct *B. dendrobatidis* isolates in sensitivity to an amphibian skin peptide mixture. This supports the hypothesis that *B. dendrobatidis* is a generalist pathogen and that species possessing an innate immunologic defense at the time of disease emergence are more likely to survive.
Descriptors: *Bufo boreas*, *Batrachochytrium dendrobatidis*, amphibians, antimicrobial cationic peptides, chytridiomycota pathogenicity, disease susceptibility, mycoses, wild animals, emerging communicable diseases, conservation of natural resources, predictive value of tests, species specificity, mass spectrometry, matrix assisted laser desorption ionization, survival rate.

Woodhams, D.C., R.A. Alford, and G. Marantelli (2003). **Emerging disease of amphibians cured by elevated body temperature.** *Diseases of Aquatic Organisms* 55(1): 65-67. ISSN: 0177-5103.
Online: http://dx.doi.org/10.3354/dao055065
Descriptors: amphibians, emerging diseases, cured, elevated body temperature.

Wright, K. (2003). **Cholesterol, corneal lipidosis, and xanthomatosis in amphibians.** *Veterinary Clinics of North America, Exotic Animal Practice* 6(1): 155-167. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Many captive amphibians have high serum or plasma cholesterol and concomittant lesions such as corneal lipidosis and xanthomas. The underlying cause of this disorder is unknown, but it is likely that a diet high in cholesterol plays a role. The metabolism of lipids in healthy amphibians remains poorly documented, which makes it challenging to interpret the findings in affected specimens. Affected amphibians should be maintained on a low-cholesterol diet and fed sparingly, and their captive environment modified to provide an optimal temperature gradient for thermoregulation.

Descriptors: amphibians, corneal lipidosis, xanthomatosis, cholesterol, captive, diet, low cholesterol, thermoreglation.

Xie Jian, Li Zheng Qiu, Zhang Qi Ya, and Li Wen Xin (2002). **Detection of *Rana grylio* virus (rgv) in host frog tissues by using immunohistochemistry assay**. *Acta Hydrobiologica Sinica* 26(5): 438-443. ISSN: 1000-3207.
NAL Call Number: QH540
Descriptors: amphibians, frogs, *Rana grylio* virus, infection, detection, frog tissues, immunohistochemistry assay, heart, lung, spleen, liver, RGV.
Language of Text: Chinese.

Yu, Y.H., S.C. Zhang, Y.J. Zhao, J. Shi, L.H. Yu, and Q.F. Lu (2006). **Chytridiomycosis and amphibian population declines.** *Chinese Journal of Zoology* 41(3): 118-122. ISSN: 0250-3263.
Descriptors: amphibians, population declines, fungal disease, Chytridiomycosis, characteristics , literature review.
Language of Text: Chinese; Summary in Chinese and English.

General

Anonymous (2005). **Amphibian biology: Endocrinology.** *Amphibian Biology* 6: 2021-2405.
Descriptors: amphibian, biology, endocrinology, review.
Notes: Special issue on endocrinology, edited by Harold Heatwole. Papers indexed separately.

Acevedo, M.A. and L.J. Villanueva Rivera (2006). **Using automated digital recording systems as effective tools for the monitoring of birds and amphibians.** *Wildlife Society Bulletin* 34(1): 211-214. ISSN: 0091-7648.
NAL Call Number: SK357.A1W5
Descriptors: amphibians, birds, conservation measures, automated digital recording systems, monitoring.

Andia, B.N. and H.N. Behera (2005). **Life span, sexual maturity and age determination of Indian bull frog, *Rana tigrina* using skeletochronology.** *Proceedings of the National Academy of Sciences India Section B Biological Sciences* 75(4): 261-270. ISSN: 0369-8211.
NAL Call Number: Q73.N311
Descriptors: bullfrog, *Rana tigrina*, age determination, sexual maturity, life span, skeletochronology.

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

Baier, J. (2006). **Guidelines for euthanasia of nondomestic animals.** In: C.K. Baer *Amphibians,* American Association of Zoo Veterinarians: Lawrence, USA, p. 39-41. ISBN: 0689707266.
Descriptors: animal welfare, drugs, euthanasia, guidelines, methodology, techniques, nondomestic animals, zoo animals, amphibians, book chapter.

Blaustein, A.R., A.C. Hatch, L.K. Belden, E. Scheessele and J.M. Kiesecker (2003). **Global change. Challenges facing amphibians.** In: R.D. Semlitsch (Editor), *Amphibian Conservation.,* Smithsonian Books: Washington, DC, p. 187-198. ISBN: 1588341194.
NAL Call Number: QL644.7 .A47 2003
Descriptors: amphibian declines, global populations, environmental changes.

Broquet, T., L. Berset Braendli, G. Emaresi, and L. Fumagalli (2007). **Buccal swabs allow efficient and reliable microsatellite genotyping in amphibians**. *Conservation Genetics* 8(2): 509-511 . ISSN: 1566-0621.
Descriptors: amphibians, buccal swabs , microsatellite genotyping, efficient, reliable.

Buchanan, B.W. (2006). **Observed and potential effects of artificial night lighting on anuran amphibians.** In: C. Rich and T. Longcore (Editors), *Ecological Consequences of Artificial Night Lighting.,* Island Press: Washington, DC, p. 192-200. ISBN: 1559631287.
NAL Call Number: QH545.E98 E26 2006
Descriptors: amphibians, anurans, exterior lighting, environmental aspects, artificial night lighting, observed and potential effects.

Busack, S.D. (2006). ***Discoglossus pictus* (painted frog).** *Herpetological Review* 37(1): 99. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: painted frog, *Discoglossus pictus*, Tunisia.

Calzolai, L., D.A. Lysek, D.R. Perez, P. Guntert, and K. Wuthrich (2005). **Prion protein NMR structures of chickens, turtles, and frogs.** *Proceedings of the National Academy of Sciences of the United States of America* 102(3): 651-655. ISSN: print: 0027-8424; online: 1091-6490.
NAL Call Number: 500 N21P
Abstract: The NMR structures of the recombinant prion proteins from chicken (*Gallus gallus*; chPrP), the red-eared slider turtle (*Trachemys scripta*; tPrP), and the African clawed frog (*Xenopus laevis*; xlPrP) are presented. The amino acid sequences of these prion proteins show approximately 30% identity with mammalian prion proteins. All three species form the same molecular architecture as mammalian PrP(C), with a long, flexibly disordered tail attached to the N-terminal end of a globular domain. The globular domain in chPrP and tPrP contains three alpha-helices, one short 3(10)-helix, and a short antiparallel beta-sheet. In xlPrP, the globular domain includes three alpha-helices and a somewhat longer beta-sheet than in the other species. The spatial arrangement of these regular secondary structures coincides closely with that of the globular domain in mammalian prion proteins. Based on the low sequence identity to mammalian PrPs, comparison of chPrP, tPrP, and xlPrP with mammalian PrP(C) structures is used to identify a set of essential amino acid positions for the preservation of the same PrP(C) fold in birds, reptiles, amphibians, and mammals. There are additional conserved residues without apparent structural roles, which are of interest for the ongoing search for physiological functions of PrP(C) in healthy organisms.
Descriptors: prions, nuclear magnetic resonance spectroscopy, chickens, *Trachemys scripta*, turtles, *Xenopus laevis*, frogs, amino acid sequences, protein secondary structure.

Caramaschi, U., R.O. De Sa, and W.R. Heyer (2005). **Common names for the frog genus *Leptodactylus* (Amphibia, Anura, Leptodactylidae).** *Herpetological Review* 36(2): 119-120. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: frog genus, *Leptodactylus*, vernacular names, common name use, proposal.

Casas Andreu, G., F.R. Mendez de la Cruz and X. Aguilar Miguel (2004). **Anfibios y reptiles. [Amphibians and reptiles.]**. In: A.J. Garcia-Mendoza, M.d.J. Ordonez and M. Briones-Salas (Editors), *Biodiversidad De Oaxaca. [Biodiversity of Oaxaca.],* Universidad Nacional Autonoma de Mexico: Mexico, p. 375-390. ISBN: 9703220452.

Descriptors: amphibians, reptiles, biological conservation.
Language of Text: Spanish; Summary in English and Spanish.

Channing, A., D.C. Moyer, and A. Dawood (2004). **A new sand frog from central tanzania (Anura: Ranidae: *Tomopterna*)**. *African Journal of Herpetology* 53(1): 21-28. ISSN: 0441-6651.
Descriptors: amphibians, new sand frog, genus *Tomopterna*, advertisement call, color pattern, morphology, differences, Tanzania.

Chinathamby, K., R.D. Reina, P.C.E. Bailey, and B.K. Lees (2006). **Effects of salinity on the survival, growth and development of tadpoles of the brown tree frog, *Litoria ewingii***. *Australian Journal of Zoology* 54(2): 97-105. ISSN: 0004-959X.
NAL Call Number: 410 Au73
Descriptors: amphibians, brown tree frog, *Litoria ewingii*, salinity, effect, growth, development, tadpoles, survival.

Conlon, J.M. (2004). **The therapeutic potential of antimicrobial peptides from frog skin**. *Reviews in Medical Microbiology* 15(1): 17-25. ISSN: 0954-139X.
Descriptors: amphibians, *Xenopus laevis*, African clawed frog, frog skin, antimicrobial peptides, therapeutic potential.

Crother, B.I., J. Boundy, J.A. Campbell, K. De Quieroz, D. Frost, D.M. Green, R. Highton, J.B. Iverson, R.W. McDiarmid, P.A. Meylan, T.W. Reeder, M.E. Seidel, J.W.J. Sites, S.G. Tilley, and D.B. Wake (2003). **Scientific and standard English names of amphibians and reptiles of North America north of Mexico: update.** *Herpetological Review* 34(3): 196-203. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: amphibians, reptiles, Mexico, scientific and English names, North America.

Davis, J.G. and N.A. Fath (2006). ***Ambystoma tigrinum tigrinum* (eastern tiger salamander).** *Herpetological Review* 37(2): 236. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: eastern tiger salamander, *Ambystoma tigrinum tigrinum* , description.

Davit Beal, T., H. Chisaka, S. Delgado, and J.Y. Sire (2007). **Amphibian teeth: current knowledge, unanswered questions, and some directions for future research.** *Biological Reviews of the Cambridge Philosophical Society* 82(1): 49-81. ISSN: print: 1464-7931; online: 1469-185X.
Abstract: Elucidation of the mechanisms controlling early development and organogenesis is currently progressing in several model species and a new field of research, evolutionary developmental biology, which integrates developmental and comparative approaches, has emerged. Although the expression pattern of many genes during tooth development in mammals is known, data on other lineages are virtually non-existent. Comparison of tooth development, and particularly of gene expression (and function) during tooth morphogenesis and differentiation, in representative species of various vertebrate lineages is a prerequisite to understand what makes one tooth different from another. Amphibians appear to be good candidates

for such research for several reasons: tooth structure is similar to that in mammals, teeth are renewed continuously during life (=polyphyodonty), some species are easy to breed in the laboratory, and a large amount of morphological data are already available on diverse aspects of tooth biology in various species. The aim of this review is to evaluate current knowledge on amphibian teeth, principally concerning tooth development and replacement (including resorption), and changes in morphology and structure during ontogeny and metamorphosis. Throughout this review we highlight important questions which remain to be answered and that could be addressed using comparative morphological studies and molecular techniques. We illustrate several aspects of amphibian tooth biology using data obtained for the caudate Pleurodeles waltl. This salamander has been used extensively in experimental embryology research during the past century and appears to be one of the most favourable amphibian species to use as a model in studies of tooth development.
Descriptors: amphibia, salamander, anatomy, histology, tooth physiology, teeth, current knowledge, development, morphogenesis, animal model.

de Silva, A. (2004). **Some field techniques and sampling methods for amphibians.** *Frog Leg* 11: 6-8. ISSN: print: 0971-6378; online: 0973-2551.
Descriptors: amphibians, field techniques, sampling methods.

Dolan, C.R., J.T. Lamer, and J.K. Tucker (2006). ***Rana sphenocephala* (southern leopard frog).** *Herpetological Review* 37(1): 102. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: *Rana sphenocephala*, southern leopard frog, amphibian, description, USA.

Douglas, R. (2002). **The semantics of resting states in reptiles and amphibians.** *African Herp News* 34: 4-8. ISSN: 1017-6187.
Descriptors: amphibians, reptiles, whole animal physiology, concepts, definitions, terminology of resting states, review, discussion.

Duffey, E. (2004). **Frogs, toads and *Dolomedes* species.** *British Arachnological Society Newsletter* 101: 3-4. ISSN: 0959-2261.
Descriptors: frogs, toads, *Dolomedes* species, amphibians.

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NAL Call Number: QL785 .C545 2004
Descriptors: amphibians, shapes, visual world, motion perception, learning in animals.

Fidenci, P. (2006). ***Barbourula busuangensis* (Philippine discoglossid frog).** *Herpetological Review* 37(1): 98. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: discoglossid frog, *Barbourula busuangensis*, Philippines.

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Descriptors: amphibians, amphibian deformities, protocol for monitoring, temperate zone conditions, herpetological methods.

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Descriptors: wood frog, *Rana sylvatica*, breeding, behavior.

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NAL Call Number: QH195.M2 N38 2003
Descriptors: amphibians, natural history, Madagascar.

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NAL Call Number: QL640.H47
Descriptors: Eastern American toad, *Bufo americanus americanus*, amphibian.

Glorioso, B.M., E.L. Young, and M.L. Niemiller (2006). ***Ambystoma talpoideum* (mole salamander).** *Herpetological Review* 37(1): 97. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: mole salamander, *Ambystoma talpoideum*, amphibians.

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NAL Call Number: QL640.H47
Descriptors: frogs, mouth, buccal swabs, DNA collection, amphibians, method.

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NAL Call Number: SF997.5.E95 E97
Descriptors: amphibians, oral biology, conditions, diseases, tongue, mouth.

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NAL Call Number: QH75.A1C5
Descriptors: amphibians, caecilian amphibians, frogs, salamanders, conservation biology.
Language of Text: Spanish.

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Online: http://www.arav.org/
NAL Call Number: SF996.A77
Descriptors: amphibians, reptiles, circadian rhythms, conference proceedings.

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NAL Call Number: 472 N21
Descriptors: tungara frog, complex call production, animal communication, anatomy.

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Descriptors: amphibians, reptiles, encyclopedia.

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Descriptors: amphibians, fish, invertebrates, oncology, models, sentinals, poikilothermic vertebrates, bioassy subjects, neoplasms.

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Descriptors: amphibians, wet sponge model for amphibian thermal biology, temperature, thermal biology.

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Descriptors: amphibians, reptiles, hygenic evaluation, Cryptosporidia, amebas, *Salmonella*, pets, disease transmission, vivarium, infectious diseases.
Language of Text: German.
Notes: Meeting Information: Vortrage der 36. jahrestagung der Osterreichischen Gesellschaft fur Tropenmedizin und Parasitologie.

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Descriptors: amphibians, *Xenopus tropicalis*, BAC library, construction, model, genomic studies.

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Descriptors: amphibians, conservation, literature review, genetic techniques, microsatellite markers use in conservation genetics, nucleic acids, genetics, molecular genetics, review.

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NAL Call Number: 500 N21P
Descriptors: amphibia, animal diseases epidemiology, biodiversity, communicable diseases veterinary, communicable diseases epidemiology.
Notes: Comment On: Proc Natl Acad Sci U S A. 2006 Feb 28;103(9):3165-70.

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NAL Call Number: QL644.7 .A48 2005
Descriptors: amphibians, limbs, parasites, limb malformations, diseases, amphibian declines.

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Descriptors: amphibians, malformations, trematode infection, parasitic disease , infectious disease, predation, synergistic effect, parasitism.

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Descriptors: amphibians, conservation area, zoological survey, checklists, Melghat Tiger Reserve, India.

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NAL Call Number: QL640.H47
Descriptors: pig nosed frog, *Hemisus marmoratus*, restraining techniques, immobilization, radiotransmitter implantation, movement patterns.

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Descriptors: amphibians, frog, *Xenopus laevis*, hypergravity environments, effects, development, gene expression, apoptosis, brain, eyes.

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NAL Call Number: QL1.Z68
Descriptors: amphibians, high magnetic field, effect, meeting.
Notes: Meeting Information: 76th Annual Meeting of the Zoological Society of Japan, Tsukuba, Japan; October 6-8, 2005.

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NAL Call Number: 444.8 G28
Descriptors: amphibians, vertebrates, literature review, pituitary gland, hypophyseal development, origins, phylogenetic considerations, phylogeny, pituitary developmental aspects, review.

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Abstract: The robust nature of vocal communication in frogs has long attracted the attention of natural philosophers and their biologically inclined successors. Each frog species produces distinctive calls that facilitate pre-mating reproductive isolation and thus speciation. In many terrestrial species, a chorus of simultaneously calling males attracts females to breeding sites; reproductive females then choose and locate one male, using distinctive acoustic cues. Males compete with each other vocally and sometimes physically as well. Anuran acoustic signaling systems are thus subject to the strong pressures of sexual selection. We are beginning to understand the ways in which vocal signals are produced and decoded by the nervous system and the roles of neurally active hormones in both processes.
Descriptors: frogs, vocal communication, animal communication, auditory perception, physiology, Ranidae, sexual behavior, mating, reproductive isolation, brain physiology, cues, models, animal, neuropeptides, neurosecretory systems.

Kunz, K. (2006). **Merlins Zwergkrallenfrosch - Neuigkeiten ueber einen kaum bekannten Sonderling. [Dwarf clawed frogs - news on a little known species.]**. *Amazonas* 4: 47-51.
Descriptors: dwarf clawed frogs, *Hymenochirus merlini*, little known species, biological notes.
Language of Text: German.

Kwet, A. (2005). ***Reptilien Und Amphibien Europas. [Reptiles and Amphibians of Europe.]***, Franckh Kosmos: Stuttgart, 252 p. ISBN: 3440102378.
Descriptors: amphibians, reptiles, Europe.
Language of Text: German.

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Descriptors: amphibians, reptiles, report, annual review, England.

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Descriptors: amphibian, skull, evolution, morphology, development.
Language of Text: English; Russian.

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NAL Call Number: QH367.5.M56
Descriptors: amphibia genetics, amphibia physiology, evolution, molecular, phylogeny, time factors.

Lever, C. (2003). ***Naturalized Reptiles and Amphibians of the World.***, Oxford University Press: Oxford, 318 p. ISBN: 0198507712.
Descriptors: amphibians, reptiles, species, worldwide.

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Descriptors: amphibians, decline, history, current research, polution, diseases.

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Descriptors: amphibians, literature review, behavioral and morphological asymmetries, symmetry, behavior, review.

Malashichev, Y.B. and L.J.E. Rogers (2002). **Behavioural and morphological asymmetries in amphibians and reptiles. Proceedings of the 4th World Congress of Herpetology satellite symposium.** *Laterality* 7(3): 195-299. ISSN: 1357-650X.
Descriptors: amphibians, reptiles, symmetry, behavior, asymmetries, symposium on behavioral and morphological asymmetries, proceedings, meetings.
Notes: Proceedings of meeting held in Sri Lanka.

Mason, M.J. (2007). **Pathways for sound transmission to the inner ear in amphibians**. In: *Springer Handbook of Auditory Research.* Vol. 28, 147-183, Springer: New York, NYISBN: 0387325212.
Descriptors: amphibians, sound transmission, pathways, inner ear, sensory system, hearing, book chapter.

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NAL Call Number: QL668.E2 M33 2002

Descriptors: frogs, toads, reproducton, mating, feeding, development, physiology, bibliography.

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NAL Call Number: SF996.A77
Descriptors: amphibians, reptiles, CITES, other regulations, review, legislation, USA, conference proceedings.

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NAL Call Number: QL671.M8
Descriptors: Oregon spotted frogs, *Rana pretiosa*, marking, radiotelemetry, methods, evaluation, USA.

Muths, E. (2003). **A radio transmitter belt for small ranid frogs.** *Herpetological Review* 34(4): 345-348. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: small ranid frogs, *Rana sylvatica*, radio telemetry, radio transmitter belt.

Naitoh, T., M. Yamashita, and R.J. Wassersug (2004). **Life history of amphibians and gravity.** *Uchu Seibutsu Kagaku* 18(3): 130-131. ISSN: 0914-9201.
Abstract: Anurans hold a unique position in vertebrate phylogeny, as they made the major transition from water to land. Through evolution they have acquired fundamental mechanisms to adapt to terrestrial gravity. Such mechanisms are now shared among other terrestrial vertebrates derived from ancestral amphibians. Space research, using amphibians as a model animal, is significant based on the following aspects: (1) Anuran amphibians show drastic changes in their living niche during their metamorphosis. Environments for tadpoles and for terrestrial life of frogs are quite different in terms of gravity and its associated factors. (2) Certain tadpoles, such as *Rhacophorus viridis amamiensis*, have a transparent abdominal wall. Thus visceral organs and their motion can be observed in these animals in non-invasive manner through their transparent abdominal skin. This feature enables biologists to evaluate the physiological state of these amphibians and study the autonomic control of visceral organs. It is also feasible for space biologists to examine how such autonomic regulation could be altered by microgravity and exposure to the space environment.
Descriptors: amphibians, physiology, anura physiology, developmental biology, gastrointestinal tract physiology, amphibia classification, amphibia growth, development , anura, classification, anura growth, development, evolution, larva growth, development, larva physiology, animal models, space flight, weightlessness.

Palmer, C.A. and L.D. Houck (2005). **Responses to sex- and species-specific chemical signals in allopatric and sympatric salamander species.** In: R.T. Mason, M.P. LeMaster and D. Mueller-Schwarze (Editors), *Chemical Signals in Vertebrates 10,* Springer Science+Business Media, Inc.: New York, p. 32-41. ISBN: 0387251596.
NAL Call Number: QP455 .I54 2003
Descriptors: amphibians, salamanders, chemical signals, sex, species-specific responses.
Notes: Proceedings of the Tenth International Symposium on Chemical Signals in Vertebrates, held July 29-August 1, 2003, in Corvallis, Oregon, US.

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NAL Call Number: QH75.A1 C56
Descriptors: two ranid frogs, simple RFLP method for identification.

Pang, Q.P., Y. Ye, and Y.T. Wen (2002). **Chromosome data of Chinese amphibians.** *Chinese Journal of Zoology* 37(4): 49-62. ISSN: 0250-3263.
Descriptors: amphibians, literature review, chromosomes, characteristics, chromosome characteristics, review, China.
Language of Text: Chinese; Summary in Chinese.

Pukala, T.L., J.H. Bowie, V.M. Maselli, I.F. Musgrave, and M.J. Tyler (2006). **Host-defence peptides from the glandular secretions of amphibians: structure and activity.** *Natural Product Reports* 23(3): 368-393. ISSN: print: 0265-0568; online: 1460-4752.
Descriptors: amphibia, amphibian proteins chemistry, proteins genetics, metabolism, secretion, antimicrobial cationic peptides chemistry, peptides genetics, peptides metabolism, peptides secretion, amino acid sequence, evolution, molecular sequence data.

Pyke, G.H. (2002). **A review of the biology of the Southern Bell Frog *Litoria raniformis* (Anura: Hylidae).** *Australian Zoologist* 32(1): 32-48. ISSN: 0067-2238.
Descriptors: amphibians, frog, *Litoria raniformis*, conservation, literature review, biology, conservation, distribution, review, Australia, south east.

Rajchard, J. (2006). **Antipredator pheromones in amphibians: A review**. *Veterinarni Medicina* 51(8): 409-413. ISSN: 0375-8427.
Online: http://www.vri.cz/docs/vetmed/51-8-409.pdf
NAL Call Number: 41.9 C333
Descriptors: amphibians, antipredator pheromones, behavior, vermonasal system, chemosignals, tadpoles, *Rana*, literature review.

Reiss, J.O. (2002). **The phylogeny of amphibian metamorphosis.** *Zoology [Jena]* 105(2): 85-96. ISSN: 0944-2006.
NAL Call Number: QL1.Z769
Descriptors: amphibians, metamorphosis, phylogeny, skull, morphological changes.

Relyea, R.A., N.M. Schoeppner, and J.T. Hoverman (2005). **Pesticides and amphibians: the importance of community context.** *Ecological Applications* 15(4): 1125-1134. ISSN: 1051-0761.
NAL Call Number: QH540.E23
Descriptors: malathion, insecticide residues, glyphosate, herbicide residues, ecotoxicology, toxicity, *Hyla*, *Bufo americanus*, *Rana pipiens*, developmental stages, adult animals, food webs, community ecology, predators, predator prey relationships, water pollution, Dytiscidae, aquatic organisms, *Dytiscus*, *Notophthalmus viridescens*, eastern newt.

Rodriguez Robles, J.A., D.A. Good, and D.B. Wake (2003). **Brief history of herpetology in the Museum of Vertebrate Zoology, University of California, Berkeley, with a list of type specimens of recent amphibians and reptiles.** *University of California Publications in Zoology* 131: 1-119. ISSN: 0068-6506.
Descriptors: amphibians, type specimens, herpetology, brief history, Museum of Vertebrate Zoology, Berkeley, University of California, reptiles, recent.

Rose, G.J. and D.M. Gooler (2007). **Function of the amphibian central auditory system**. In: *Springer Handbook of Auditory Research.* Vol. 28, 250-290, Springer: New York, NYISBN: 0387325212.
Descriptors: amphibians, central auditory system, function, hearing, sensory system, book chapter.

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Online: http://www.ias.ac.in/jbiosci/jun2002/187.pdf
NAL Call Number: QH1.J63
Descriptors: amphibians, environmental sentinals, pollution, toxic chemicals, contamination.

Ruchin, A.B. (2003). **Effects of permanent and variable illumination on development of the clawed frog *Xenopus laevis* larvae.** *Zoologicheskii Zhurnal* 82(7): 834-838. ISSN: 0044-5134.
Descriptors: amphibians, clawed frog, *Xenopus laevis*, development, illumination, permanent, varaiable, effects, larvae.
Language of Text: Russian.

Ruchin, A.B. (2002). **Effects of monochromatic light on growth and development of the clawed frog *Xenopus laevis* larvae.** *Zoologicheskii Zhurnal* 81(6): 752-756. ISSN: 0044-5134.
Descriptors: clawed frog, *Xenopus laevis*, growth, development, effects of monochromatic light, larvae, tadpoles.
Language of Text: Russian.

Smotherman, M. and P. Narins (2004). **Evolution of the amphibian ear.** *Springer Handbook of Auditory Research* 22: 164-199. ISSN: 0947-2657.
Descriptors: amphibians, evolution of amphibian ear, auditory, acoustic.

Staniszewski, M. (2002). **Schwanzlurche. [Salamanders.]**. *Reptilia D* 7(2): 22-29; Nr 34. ISSN: 1431-8997.
Descriptors: amphibians, salamander, caudata, species diversity.
Language of Text: German.

Stebbins, R.C. (2003). ***A Field Guide to Western Reptiles and Amphibians***, 3rd edition, Houghton Mifflin Company: Boston and New York, 533 p. ISBN: 0395982723.
Descriptors: amphibians, reptiles, field guide, western United States.

Steinberg, C.E.W., S. Hoss, W. Kloas, I. Lutz, T. Meinelt, S. Pflugmacher, and C. Wiegand (2004). **Hormonelike effects of humic substances on fish, amphibians, and invertebrates.** *Environmental Toxicology* 19(4): 409-411. ISSN: print: 1520-4081; online: 1522-7278.
NAL Call Number: RA1221.T69
Descriptors: amphibians, fish, invertebrates, humic substances, hormonelike effects, toxicity.
Notes: In the special issue: 11th International Symposium on Toxicity Assessment / edited by L. Manusadzianas. Includes references.

Stewart, E.R., S.A. Reese, and G.R. Ultsch (2004). **The physiology of hibernation in Canadian leopard frogs (*Rana pipiens*) and bullfrogs (*Rana catesbeiana*).** *Physiological and Biochemical Zoology* 77(1): 65-73. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Descriptors: leopard frog, *Rana pipiens*, bullfrog, *Rana catesbeiana*, hibernation, physiology.

Thomsen, G.H. (2006). **A new century of amphibian developmental biology.** *Seminars in Cell and Developmental Biology* 17(1): 78-79. ISSN: 1084-9521.
Descriptors: frog, body patterning, morphogenesis, *Xenopus* embryology, xenopus growth and development, cell polarity, oocytes physiology, *Xenopus* anatomy and histology.
Notes: Comment On: Semin Cell Dev Biol. 2006 Feb;17(1):110-6.

Uteshev, V. and E. Gakhova (2005). **Gene cryobanks for conservation of endangered amphibian species.** *Russian Journal of Herpetology* 12: 233-234 (Suppl.) ISSN: 1026-2296.
Descriptors: amphibians, conservation, gene cryobanks, endangered species, genetic techniques.

Venturino, A., E. Rosenbaum, A. Caballero de Castro, O.L. Anguiano, L. Gauna, T. Fonovich de Schroeder, and A.M. Pechen de d'Angelo (2003). **Biomarkers of effect in toads and frogs.** *Biomarkers* 8(3-4): 167-186. ISSN: 1354-750X.
Descriptors: toads, frogs, Bufo, biomarkers of effect.

Wilczynski, W. and H. Endepols (2007). **Central auditory pathways in anuran amphibians: the anatomical basis of hearing and sound communication**. In: *Springer Handbook of Auditory Research.* Vol. 28, Springer: New York, NY, p. 221-249. ISBN: 0387325212.
Descriptors: amphibians, hearing, sound communication, central auditory pathways, anatomical basis, book chapter.

Wright, K. (2006). **Veterinary advances that impact amphibian conservation**. *Small Animal and Exotics Proceedings of the North American Veterinary Conference.* 20: 1783-1785. ISSN: 0003-1488.
Online: http://www.tnavc.org
Descriptors: amphibians, veterinary advances, drugs, treatment, conservation, diagnosis, conference proceedings.

Wright, K. (2006). **Common medical problems of amphibians**. *Small Animal and Exotics Proceedings of the North American Veterinary Conference.* 20: 1689-1691. ISSN: 0003-1488.
Online: http://www.tnavc.org
Descriptors: amphibians, common medical problems, exotics, veterinary conference.

Wright, K. (2006). **Important clinical aspects of amphibian physiology**. *Small Animal and Exotics Proceedings of the North American Veterinary Conference.* 20: 1686-1688. ISSN: 0003-1488.
Online: http://www.tnavc.org
Descriptors: anatomy, animal physiology, body temperature, calcium, dehydration, energy metabolism, exotics, homeostasis, morphology, pets, rehydration, amphibians, clinical aspects.
Notes: Meeting Information: The North American Veterinary Conference, Gainesville, USA, Orlando, Florida, USA. January 7-11, 2006.

Yanchurevich, O.V. and S.V. Emelianchic (2005). **Definition of age an amphibians by a method skeletochronology.** *Vyestsi Natsyyanal'Nai Akademii Navuk Byelarusi Syeryya Biyalahichnykh Navuk* 3: 113-117. ISSN: 1029-8940.
Descriptors: amphibians, definition of age, method, skeletochronology.
Language of Text: Russian; Summary in English.

Yu, Z.L., Q. Qiu, Z.M. Xu, and J.X. Shen (2006). **Auditory response characteristics of the piebald odorous frog and their implications.** *Journal of Comparative Physiology. A, Neuroethology, Sensory, Neural, and Behavioral Physiology* 192(8): 801-806. ISSN: 0340-7594.
NAL Call Number: QP33.J68
Abstract: The piebald odorous frog (*Odorrana schmackeri*), the large odorous frog (*Odorrana livida*) and the concave-eared torrent frog (*Amolops tormotus*) are sympatric species living near the same torrent streams in the vicinity of Mt. Huangshan, China. A recent study demonstrated that *A. tormotus* can use sound signals involving ultrasonic components for communication in a noisy environment, and another sympatric species, *O. livida*, can also perceive ultrasonic sound. Here we report data on the hearing range of *O. schmackeri* by studying auditory evoked potentials and single-unit data from the torus semicircularis. This frog exhibits its two most sensitive peaks at 2 kHz and 3.5-4.0 kHz with thresholds <42 dB SPL, with an upper frequency limit of hearing at 8.5 kHz with threshold of 87 dB SPL. The upper limit is much lower than those of *O. livida* and *A. tormotus*, at 22 and 34 kHz, respectively. It suggests that sympatric species may respond differently to similar environmental selection pressures sculpting auditory communication systems.
Descriptors: frogs, *Odorrana schmackeri*, *Odorrana livida*, *Amolops tormotus*, auditory per-

ception, hearing physiology, acoustic stimulation, brain stem cytology, radiation, evoked potentials, noise, reaction time, vocalization, animal physiology, China.

Immunity

Fournier, M., J. Robert, H.M. Salo, C. Dautremepuits, and P. Brousseau (2005). **Immunotoxicology of Amphibians.** *Applied Herpetology* 2(3): 297-309. ISSN: 1570-7539.
Descriptors: amphibians, immune system , immunotoxicology review, pollution.

Kurth, T. (2003). **Immunocytochemistry of the amphibian embryo: From overview to ultrastructure.** *International Journal of Developmental Biology* 47(5): 373-383. ISSN: 0214-6282.
Descriptors: amphibians, immunocytochemistry, embryo, overview, ultrastructure.

Lee, J.H., S.K. Ku, H.S. Lee, and H. Kitagawa (2003). **An immunohistochemical study of endocrine cells in the pancreas of the red-bellied frog (*Bombina orientalis*).** *European Journal of Histochemistry* 47(2): 165-172. ISSN: 1121-760X.
Descriptors: red-bellied frog, *Bombina orientalis*, endocrine cells, pancreas, immunohistochemical study.

Rollins Smith, L.A., D.C. Woodhams, L.K. Reinert , V.T. Vredenburg, C.J. Briggs, P.F. Nielsen, and J. Michael Conlon (2006). **Antimicrobial peptide defenses of the mountain yellow-legged frog (*Rana muscosa*).** *Developmental and Comparative Immunology* 30(9): 831-842. ISSN: 0145-305X.
Abstract: The mountain yellow-legged frog (*Rana muscosa*) inhabits high elevation lakes in California that are largely undisturbed by human activities. In spite of this habitation in remote sites, populations continue to decline. Although predation by non-native fish is one cause for declines, some isolated populations in fishless lakes are suffering new declines. One possible cause of the current wave of declines is the introduction of the pathogenic chytrid fungus (*Batrachochytrium dendrobatidis*) which invades the adult skin to cause chytridiomycosis. In many amphibian species, the skin is protected by antimicrobial peptides secreted into the mucous. Here we show that *R. muscosa* produces three previously unknown antimicrobial peptides belonging to the ranatuerin-2 and temporin-1 families of antimicrobial peptides. These three peptides, along with bradykinin, are the most abundant peptides in the skin secretions detected by mass spectrometry. Natural mixtures of peptides and individual purified peptides strongly inhibit chytrid growth. The concentration of total peptides recovered from the skin of frogs following a mild norepinephrine induction is sufficient to inhibit chytrid growth in vitro. A comparison of the species susceptibility to chytridiomycosis and the antichytrid activity of peptides between *R. muscosa* and *R. pipiens* suggest that although *R. muscosa* produces more total skin peptides, it appears to be more vulnerable to *B. dendrobatidis* in nature. Possible differences in the antimicrobial peptide repertoires and life history traits of the two species that may account for differences in susceptibility are discussed.
Descriptors: mountain yellow-legged frog, *Rana muscosa*, amphibian proteins, *Batrachochytrium dendrobatidis*, pathogenic chytrid fungus, chytridiomycosis, dermatomycoses, decline of amphibian populations, antimicrobial peptides, disease susceptibility.

Rollins Smith, L.A. and N. Cohen (2005). **Hormones and the immune system of amphibians.** *Amphibian Biology* 6: 2377-2391. ISSN: 0386-3166.
Descriptors: amphibians, hormones, immune system, review, immunology.

Parasites

Al Sorkhy, M.K. and Z. Amr (2003). **Platyhelminth parasites of some amphibians in Jordan.** *Turkish Journal of Zoology* 27(2): 89-93. ISSN: 1300-0179.
Online: http://mistug.tubitak.gov.tr/bdyim/abs.php?dergi=zoo&rak=0201-8
Descriptors: platyhelminth parasites, amphibians, parasitological survey, Jordan.
Language of Text: English; Turkish.

Aly Khan and F.M. Bilqees (2005). **A new trematode, *Mehraorchis cribbi* sp. nov., from the small intestine of frog**. *International Journal of Biology and Biotechnology* 2(3): 517-519. ISSN: 1810-2719.
Online: http://www.ijbbku.org
Descriptors: amphibians, frog, small intestine, trematode, *Mehraorchis cribbi*, Pakistan.

Barton, D.P. and J. Riley (2004). ***Raillietiella indica* (Pentastomida) from the lungs of the giant toad, *Bufo marinus* (Amphibia), in Hawaii, U.S.A.** *Comparative Parasitology* 71(2): 251-254. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: giant toad, *Bufo marinus*, pentastomid parasites, lung, *Raillietiella indica*, Hawaii.

Bentz, S., N.D. Sinnappah Kang, L.H.S. Lim, B. Lebedev, C. Combes, and O. Verneau (2006). **Historical biogeography of amphibian parasites, genus *Polystoma* (Monogenea: Polystomatidae).** *Journal of Biogeography* 33(4): 742-749. ISSN: 0305-0270.
NAL Call Number: QH1.J62
Descriptors: amphibian, parasites, *Polystoma*, hyloids, ranoids, phylogeny, neobatrachian parasites.

Bhutia, P.T. (2006). **Trematodes of amphibian.** In: J.R.B. Alfred (Editor), *Fauna of Arunachal Pradesh (Part 2),* State Fauna Series, Zoological Survey of India: Kolkata, p. 49-53. ISBN: 8181710878.
NAL Call Number: QL309 .F357 2006
Descriptors: amphibians, parasites, trematodes, India.

Bilqees, F.M. and Aly Khan (2003). **On two new digenetic trematodes from amphibians of Sindh, Pakistan**. *Pakistan Journal of Zoology* 35(3): 211-213. ISSN: 0030-9923.
NAL Call Number: QL1.P3
Descriptors: amphibians, *Rana cyanophlyctis*, parasite, new nematodes, new species, small intestine, Temiorchis, Loxogenes, Pakistan.

Bolek, M.G. (2006). ***The role of arthropod second intermediate hosts as avenues for and constraints on the transmission of frog lung flukes (Digenea: Haematoloechidae).*** Dissertation, University of Nebraska-Lincoln: 198 p.
Online: http://digitalcommons.unl.edu/dissertations/AAI3214778/
Descriptors: frog, lung flukes, intermediate hosts, transmission, parasites.
Notes: UMI publication number: AAT 3214778.

Bolek, M.G. and J.R. Coggins (2003). **Helminth community structure of sympatric eastern American toad, *Bufo americanus americanus*, northern leopard frog, *Rana pipiens*, and blue-spotted salamander, *Ambystoma laterale*, from southeastern Wisconsin.** *Journal of Parasitology* 89(4): 673-680. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Descriptors: toad, frog, salamander, amphibians, helminth parasites.

Bolek, M.G. and J.R. Coggins (2002). **Observations on myiasis by the calliphorid, bufolucilia silvarum, in the eastern american toad (*Bufo americanus americanus*) from southeastern wisconsin.** *Journal of Wildlife Diseases* 38(3): 598-603. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: amphibians, toad, blow flies, myiasis, eggs, maggots, skin penetration, infection.

Bursey, C.R. and S.R. Goldberg (2007). **A new species of oxyascaris (nematoda, cosmocercidae) in the costa rica brook frog, *Duellmanohyla uranochroa* (anura, hylidae)**. *Acta Parasitologica* 52(1): 58-61. ISSN: 1230-2821.
NAL Call Number: QL757.A27
Descriptors: amphibians, frog, *Duellmanohyla uranochroa*, nematode, parasite, new species, oxyascaris, Costa Rica.

Bursey, C.R., S.R.J. Telford, and S.R. Goldberg (2003). ***Icosiella turgeocauda* n. Sp. (Nematoda: onchocercidae) and *Seuratascaris numidica* (nematoda: ascarididae), parasites of the frog, *Rana cancrivora* (anura: ranidae), from luzon, republic of the philippines.** *Journal of Parasitology* 89(2): 342-345. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Descriptors: amphibians, frog, new species of parasites, *Icosiella turgeocarda*, *Seuratascaris numidica*, Luzon, Philippines.

Bursey, C.R., D. Vrcibradic, F.H. Hatano, and C.F.D. Rocha (2006). **New genus, new species of *Acanthocephala* (Echinorhynchidae [Echinorhynchida]) from the Brazilian frog *Hylodes phyllodes* (Anura: Leptodactylidae).** *Journal of Parasitology* 92(2): 353-356. ISSN: 0022-3395.
Descriptors: Brazilian frog, *Anuracanthorhynchus tritaxisentis*, new species, amphibian hosts, *Hylodes phyllodes*, Acanthocephala, parasites.

Cabrera Guzman, E., V. Leon Regagnon, and L. Garcia Prieto (2007). **Helminth parasites of the leopard frog R*ana cf. Forreri* (Amphibia : Ranidae) in acapulco, guerrero, mexico**. *Comparative Parasitology* 74(1): 96-107. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: amphibians, helminth parasites, leopard frog, Mexico, *Rana cf. Forreri*, cestodes, nematodes, acanthocephalans.

De Martini, L., F. Oneto, M.V. Pastorino, S. Salvidio, E. Buriola, and F. Bona (2006). **A non-lethal method to sample gastrointestinal parasites from terrestrial salamanders**. *Amphibia Reptilia* 27(2): 278-280. ISSN: 0173-5373.
Descriptors: amphibians, gastrointestinal parasites, sample methods, non-lethal, terrestrial salamanders.

Doi, T. and H. Hasegawa (2006). **First record of a mermithid nematode from a frog in Japan**. *Current Herpetology* 25(1): 35-37. ISSN: 1345-5834.
Descriptors: amphibians, frog, *Rana nigromaculata*, parasites, mermithid nematode, infection, Japan.

dos Santos, E.M., M.d.C.N. Botelho, and J.B. de Oliveira (2002). **Ectoparasitos de anfibios anuros (Anura, Bufonidae) capturados na Estacao Ecologica do Tapacura, Sao Lourenco da Mata, Pernambuco, Brasil. [Ectoparasites of Amphibians (Anura, Bufonidae) captured in the Estacao Ecologica do Tapacura, Pernambuco State, Brazil.]**. *Entomologia y Vectores* 9(1): 105-113. ISSN: 0328-0381.
Descriptors: amphibians, amblyomma, amphibian hosts, *Bufo*, ectoparasite survey, Brazil, Pernambuco, Estacao Ecologica do Tapacura , ectoparasites of amphibian hosts.
Language of Text: Portuguese; Summary in English and Portuguese.

Duncan, A.E., M.M. Garner, J.L. Bartholomew, T.A. Reichard, and R.W. Nordhausen (2004). **Renal myxosporidiasis in Asian horned frogs (*Megophrys nasuta*).** *Journal of Zoo and Wildlife Medicine* 35(3): 381-386. ISSN: 1042-7260.
NAL Call Number: SF601.J6
Descriptors: amphibians, Asian horned frogs, *Megophyrs nasuta*, renal myxosporidiasis, parasite, kidneys, nephritis.

Dusen, S. (2007). **Helminths of the two mountain frogs, banded frog, *Rana camerani* Boulenger, 1886 and Uludag frog *Rana macrocnemis* Boulenger, 1885 (Anura: Ranidae), collected from the Antalya province.** *Turkiye Parazitolojii Dergisi* 31(1): 84-88. ISSN: 1300-6320.
Abstract: In this study, two mountain frogs (*Rana camerani* and *Rana macrocnemis*) were collected in the Antalya Province in south-western Turkey during 2001 and 2002 and were examined for helminths. Out of 15 *Rana camerani,* 10 (66.7%) were infected with 1 or more helminths and out of 20 *Rana macrocnemis*, 17 (85%) were infected with 1 or more helminths. The helminth fauna of *Rana camerani* included 4 species of which were 3 trematode species (*Haplometra cylindracea*, *Pleurogenoides medians*, *Opisthioglyphe rastellus*), and 1 nematode species (*Cosmocerca ornata*). The helminth fauna of *Rana macrocnemis* included 3

species with 1 trematode species (*H. cylindracea*), 1 nematode species (*C. ornata*), and 1 acanthocephalan species (*Acanthocephalus ranae*). *H. cylindracea* and *C. ornata* were observed in both of the mountain frogs.
Descriptors: amphibians, frogs, Rana, helminth parasites, trematode, nematode, Acanthocephala, Antalya province, Turkey.

Dusen, S. and M. Oz (2004). **Helminth parasites of the tree frog, *Hyla arborea* (Anura: Hylidae) from Southwest Turkey**. *Comparative Parasitology* 71(2): 258-261. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: amphibians, tree frog, *Hyla arborea*, helminth parasites, monogenetic trematode, Turkey.

Dusen, S. and M. Oz (2006). **Helminths of the marsh frog, *Rana ridibunda pallas* , 1771 (Anura : Ranidae), from antalya province, southwestern Turkey**. *Comparative Parasitology* 73(1): 121-129. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: amphibians, marsh frog, *Rana ribidunda*, helminths, infected, Turkey.

Eiras, J.C. (2005). **An overview on the myxosporean parasites in amphibians and reptiles.** *Acta Parasitologica* 50(4): 267-275. ISSN: 1230-2821.
NAL Call Number: QL757.A27
Descriptors: amphibians, reptiles, parasites, myxosporean, overview, parasite species.

Ford, T.R., D.L. Dillehay, and D.M. Mook (2004). **Cutaneous acariasis in the African clawed frog (*Xenopus laevis*).** *Comparative Medicine.* 54(6): 713-717. ISSN: 1532-0820.
NAL Call Number: SF77.C65
Descriptors: African clawed frog, *Xenopus laevis*, skin lesions, histopathology, laboratory animals, contamination , cutaneous acariasis, parasites.

Ghazi, R.R., A. Khan, and Noorun Nisa (2005). **Two new species of helminth parasites from frog (*Rana tigrina* Daudin).** *Pakistan Journal of Zoology* 37(2): 107-111. ISSN: 0030-9923.
NAL Call Number: QL1.P3
Descriptors: amphibians, frog, *Rana tigrina*, helminth parasites, two new species, *Rana tigrina.*

Gillilland, M.G.I. and P.M. Muzzall (2002). **Amphibians, trematodes, and deformities: An overview from southern Michigan.** *Comparative Parasitology* 69(1): 81-85. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: amphibians, parasites, platyhelminthes, nematoda, amphibian hosts, host deformities, Michigan, USA, review.

Goldberg, S.R. and C.R. Bursey (2003). **Helminths of the Ezo brown frog, *Rana pirica* (Ranidae), from Hokkaido Island, Japan.** *Pacific Science* 57(2): 167-169. ISSN: 0030-8870.
NAL Call Number: 475 P11
Descriptors: amphibians, Exo brown frog, *Rana pirica*, parasites, helminths, Japan.

Goldberg, S.R., C.R. Bursey, J.D. Trujillo, and H. Kaiser (2002). **Intestinal helminths of seven frog species from Trinidad and Tobago.** *Caribbean Journal of Science* 38(1-2): 147-150. ISSN: 0008-6452.
Descriptors: frogs, *Cylindrotaenia americana*, Cestoda, Acanthocephala, amphibian hosts, *Hyla microcephala*, Trinidad, Tobago, amphibian host, prevalence.

Goldberg, S.R., C.R. Bursey, and C. Wong (2002). **Helminths of the western chorus frog from eastern Alberta, Canada.** *Northwest Science* 76(1): 77-79 . ISSN: 0029-344X.
Online: http://www.vetmed.wsu.edu/org_NWS/NWSci%20journal%20articles/2002%20files/Issue%201/v76%20p77%20Goldberg%20et%20al.PDF
NAL Call Number: 470 N81
Descriptors: frog, amphibians, *Apharyngostrigea pipientis*, *Choledocystus pennsylvaniensis*, (digenea), *Cylindrotaenia americana*, (cestoda), *Oswaldocruzia leidyi*, *Rhabdias ranae*, (Nematoda), amphibian hosts, *Pseudacris triseriata*, new host record, amphibian host, Alberta Canada.

Gupta, N., P. Chandra and M. Bhaskar (2004). **Oxysomatium in amphibians and reptiles: occurrence and adaptability.** In: A. Verma (Editor), *Zoology and Human Welfare,* S.P. Mukherjee Government Degree College: Phaphamau, p. 367-370.
Descriptors: amphibians, *Bufo melanostictus*, *Hemidactylus flaviviridis*, *Rana tigrina*, reptiles, nematode parasites, *Oxysomatium bareilliana*, parasites.

Gupta, N. and A.W. Khan (2002). ***Haemogregarina bareilliana* n. sp., a blood inhabiting gregarine parasite from the toad, *Bufo melanostictus.*** *Himalayan Journal of Environment and Zoology* 16(1-2): 281-286. ISSN: 0970-2903.
Descriptors: amphibians, *Haemogregarina bareilliana*, amphibian hosts, toad, *Bufo melanostictus*, blood inhabiting gregarine parasite.

Hagman, M., T. Pape, and R. Schulte (2005). **Flesh fly myiasis (Diptera, Sarcophagidae) in Peruvian poison frogs genus *Epipedobates* (Anura, Dendrobatidae).** *Phyllomedusa* 4(1): 69-73. ISSN: 1519-1397.
Descriptors: amphibians, poison frogs, flesh fly myiasis, Diptera, Anura.

Hamann, M.I., C.E. Gonzalez, and A.I. Kehr (2006). **Helminth community structure of the oven frog *leptodactylus latinasus* (Anura, Leptodactylidae) from Corrientes, Argentina**. *Acta Parasitologica* 51(4): 294-299. ISSN: 1230-2821.
NAL Call Number: QL757.A27
Descriptors: amphibians, oven frog, *Leptodactylus latinasus*, helminth communit structure, trematodes, nematodes, kidneys, small intestine, pharyngeal zone, infection, Argentina.

Hanna, A.A. and J.E. Joy (2003). ***Oswaldocruzia pipiens* (Nematoda: Trichostrongyloidea) from the eastern american toad, *Bufo americanus americanus* (Salienta: Bufonidae), in West Virginia, USA.** *Comparative Parasitology* 70(1): 92-96. ISSN: 1525-2647.
NAL Call Number: QL392.J68

Descriptors: amphibians, toad, *Bufo americanus americanus*, parasites, Nematoda , *Oswaldocruzia pipens*, small intestine, West Virginia, USA.

Hasegawa, H. and M. Asakawa (2004). **Parasitic nematodes recorded from amphibians and reptiles in Japan.** *Current Herpetology* 23(1): 27-35. ISSN: 1345-5834.
Descriptors: amphibians, reptiles, nematode parasites, Japan.

Hasegawa, H., T. Doi, T. Tochimoto, and A. Myata (2002). **Parasitic helminths collected from the Japanese giant salamander, *Andrias japonicus* (Temminck, 1837) (Amphibia: Cryptobranchidae), in Japan.** *Comparative Parasitology* 69(1): 33-42. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: amphibians, salamander, *Andrias japonicus*, digenea, nematoda, amphibian hosts, alimentary tract survey, including parasite systematics and new host records, Japan, amphibain host, alimentary tract survey including parasite systematics and new host records.

Hsu, C.C., D.B. Carter, D.A. Williams, and C.L. Besch Williford (2004). ***Haematoloechus* sp. infection in wild-caught northern leopard frogs (*Rana pipiens*).** *Contemporary Topics in Laboratory Animal Science* 43(6): 14-16. ISSN: 1060-0558.
NAL Call Number: SF405.5.A23
Descriptors: leopard frogs, *Rana pipiens*, laboratory animals, trematode infections, Plagiorchiidae, lungs.

Ikramov, E.F. and D.A. Azimov (2004). **Gel'minty amfibii Ferganskoi doliny Uzbekistana. [Helminths of amphibians of the Fergana valley of Uzbekistan]**. *Parazitologiia* 38(1): 81-87. ISSN: 0031-1847.
NAL Call Number: QL757.A1P32
Abstract: Species diversity and some ecological peculiarities of helminthes parasitizing amphibians in the Fergana Valley of Uzbekistan have been investigated. In 652 examined specimens of amphibians (*Bufo viridis*--237, *Rana ridibunda*--415 specimens), have been found 32 helminth species belonging to 26 genera of 12 families.
Descriptors: amphibians, helminths, parasitizing amphibians, *Bufo*, *Rana*, Fergana valley, Uzbekistan.
Language of Text: Russian.

Ikramov, E.F. and D.A. Azimov (2003). **Two new nematode species found in amphibians and reptilians from the north part of Fergana Plain, Uzbekistan**. *Parazitologiya* 37(6): 512-516. ISSN: 0031-1847.
NAL Call Number: QL757.A1P32
Descriptors: amphibians, parasitic nematodes, new species, taxonomy, *Bufo viridis*, Nematoda, reptiles, *Testudo*, tortoise, toad, Uzbekistan.
Language of Text: Russian; Summary in English.

Ikromov, E.F., J.A. Azimov, and Cho MyoungRae (2004). **The helminth fauna of lake frog (*Rana ridibunda Pallas*, 1771) in Ferghana Valley, Uzbekistan**. *Journal of Asia Pacific Entomology* 7(2): 137-141. ISSN: 1226-8615.

Descriptors: amphibians, helminth fauna, lake frog, hekminth species, nematodes, cestodes, trematodes, acanthocephalans, Uzbekistan.

Jirku, M., M.G. Bolek, C.M. Whipps, J.J. Janovy, M.L. Kent, and D. Modry (2006). **A new species of *Myxidium* (Myxosporea: Myxidiidae), from the western chorus frog, *Pseudacris triseriata triseriata*, and Blanchard's cricket frog, *Acris crepitans blanchardi* (Hylidae), from eastern Nebraska: Morphology, phylogeny, and critical comments on amphibian *Myxidium* taxonomy.** *Journal of Parasitology* 92(3): 611-619. ISSN: 0022-3395.
Descriptors: chorusfrog, cricket frog, new species of *Myxidium*, phylogeny, morphology, *Myxidium* taxonomy, amphibian, comments., Nebraska, USA.

Johnson, P.T., D.R. Sutherland, J.M. Kinsella, and K.B. Lunde (2004). **Review of the trematode genus *Ribeiroia* (Psilostomidae): ecology, life history and pathogenesis with special emphasis on the amphibian malformation problem.** *Advances in Parasitology* 57: 191-253. ISSN: 0065-308X.
NAL Call Number: 436.8 Ad9
Abstract: Trematodes in the genus *Ribeiroia* have an indirect life cycle involving planorbid snails as first intermediate hosts, fishes or amphibians as second intermediate hosts and birds or mammals as definitive hosts. Although rarely pathogenic in definitive hosts, *Ribeiroia* infection can cause severe pathology and mortality in snails and amphibians. This group of parasites has gained notoriety for its prominent role in the recent rash of amphibian deformities in North America. Under some circumstances, these malformations may enhance parasite transmission by rendering infected amphibian hosts more susceptible to definitive host predators. However, increasing reports of malformations in North American amphibian populations emphasize the importance of understanding infection patterns. Here we review important aspects of the biology, ecology, life cycle and pathogenesis of parasites in the genus *Ribeiroia* and identify priorities for future research. Based on available morphological descriptions and preliminary molecular data, three species of *Ribeiroia* are recognized: *R. ondatrae* in the Americas, *R. marini* in the Caribbean and *R. congolensis/C. lileta* in Africa. We further evaluate the influence of abiotic and biotic factors in determining the intensity and prevalence of *Ribeiroia* infection and malformations in amphibians, highlighting the importance of habitat alteration and secondary factors (e.g. aquatic eutrophication, contaminants) in promoting infection. Although not a "new" parasite, *Ribeiroia* may have increased in range, prevalence, or intensity in recent years, particularly within amphibian hosts. Nevertheless, while much is known about this intriguing group of parasites, there remains much that we do not know. Particular importance for future research is placed on the following areas: evaluating the phylogenetic position of the genus, establishing the molecular mechanism of parasite-induced malformations in amphibians, isolating the drivers of parasite transmission under field conditions and studying the consequences of malformations for parasite and host populations. Investigation of these questions will benefit enormously from a multidisciplinary approach that effectively integrates parasitology, developmental biology, immunology, herpetology and aquatic ecology.
Descriptors: amphibians, *Ribeiroia*, bird diseases, fish diseases, host parasite relations, life cycle stages, snails, trematode infections, parasitology.

Johnson, P.T.J. and J.M. Chase (2004). **Parasites in the food web: Linking amphibian malformations and aquatic eutrophication**. *Ecology Letters* 7(7): 521-526. ISSN: 1461-023X.
NAL Call Number: QH540.E262
Descriptors: amphibians, aquatic animals, parasites, food web, malformations, emerging diseases, *Ribeiroia ondatrae*, aquatic eutrophication.

Johnson, P.T.J. and D.R. Sutherland (2003). **Amphibian deformities and *Ribeiroia* infection: an emerging helminthiasis**. *Trends in Parasitology* 19(8): 332-335. ISSN: 1471-4922.
NAL Call Number: QL757.P374
Descriptors: amphibians, deformities, emerging helminthiasis, malformed, trematode, *Ribeiroia*, infection, transmission.

Johnson, P.T., K.B. Lunde, D.A. Zelmer, and K. Werner (2003). **Amphibian malformations and parasite infection: an emerging disease?** *Ecological Society of America Annual Meeting Abstracts* 88: 171. ISSN: 0012-9623.
Descriptors: amphibians, malformations, parasite infection, emerging disease, meeting.
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.

Johnson, P.T.J. and K.B. Lunde (2005). **Parasite infection and limb malformations: A growing problem in amphibian conservation.** In: M.J. Lannoo (Editor), *Amphibian Declines: The Conservation Status of United States Species.,* University of California Press.: Berkeley, CA, p. 124-138. ISBN: 0520235924.
NAL Call Number: QL644.7 .A48 2005
Descriptors: amphibians, limbs, parasites, limb malformations, diseases, amphibian declines.

Johnson, P.T.J., K.B. Lunde, E.M. Thurman, E.G. Ritchie, S.N. Wray, D.R. Sutherland, J.M. Kapfer, T.J. Frest, J. Bowerman, and A.R. Blaustein (2002). **Parasite (*Ribeiroia ondatrae*) infection linked to amphibian malformations in the western United States.** *Ecological Monographs* 72(2): 151-168. ISSN: 0012-9615.
NAL Call Number: 410 Ec72
Descriptors: amphibians, *Ribeiroia ondatrae*, amphibian hosts, relationship between infection and limb malformations, USA, west, limb malformations in amphibian hosts.

Johnson, P.T.J., K.B. Lunde, D.A. Zelmer, and J.K. Werner (2003). **Limb deformities as an emerging parasitic disease in amphibians: Evidence from museum specimens and resurvey data.** *Conservation Biology* 17(6): 1724-1737. ISSN: 0888-8892.
NAL Call Number: QH75.A1C5
Descriptors: amphibians, limbs deformities, parasitic disease, emerging parasitic disease, museum specimens, resurvey data.
Language of Text: English; Spanish.

Johnson, P.T.J., E.R. Preu, D.R. Sutherland, J.M. Romansic, B. Han, and A.R. Blaustein (2006). **Adding infection to injury: synergistic effects of predation and parasitism on amphibian malformations**. *Ecology* 87(9): 2227-2235. ISSN: 0012-9658.
Descriptors: amphibians, malformations, trematode infection, parasitic disease , infectious disease, predation, synergistic effect, parasitism.

Johnson, P.T.J. and D.R. Sutherland (2003). **Amphibian deformities and *Ribeiroia* infection: An emerging helminthiasis.** *Trends in Parasitology* 19(8): 332-335. ISSN: 1471-4922.
NAL Call Number: QL757.P374
Descriptors: amphibians, parasites, *Ribeiroia ondatrae*, infection, deformities, emerging helminthiasis.

Kalavati, C. and B. Narayana Rao (2005). ***Leptotheca mackenzii* n. sp. (Myxozoa: Myxosporea) infecting the urinary bladder of the frog, *Lemnectus* [Limnonectes] *limnocharis*.** *Journal of Environment and Sociobiology* 2(1-2): 25-32.
Descriptors: amphibians, frog, parasites, myxozoa, infection, urinary bladder.

Kardousha, M.M. (2002). **Preliminary survey on parasites infecting some amphibian and reptilian species from United Arab Emirates and Qatar.** *Qatar University Science Journal* 22: 137-151. ISSN: 1023-8948.
Descriptors: amphibian, reptilian, parasites, infecting, preliminary survey, species, United Arab Emitates, Qatar.
Language of Text: Arabic; English.

Khidr, A.A., O.A. Abu Samak, and O.M. Abd El Manem (2002). **Intensity of some intestinal parasites infecting the maculated toad, *Bufo regularis* in Damietta Governorate, Egypt.** *Journal of the Egyptian German Society of Zoology* 38(D): 31-46. ISSN: 1110-5356.
NAL Call Number: QL1.E49
Descriptors: amphibians, toad, *Bufo regularis*, protozoa, digenea, Cestoda, Nematoda, Acanthocephala , amphibian hosts, intestinal parasites prevalence, distribution within host, Egypt Damietta Governorate.
Language of Text: Arabic; English.

Kiesecker, J.M. (2002). **Synergism between trematode infection and pesticide exposure: a link to amphibian limb deformities in nature?** *Proceedings of the National Academy of Sciences of the United States of America* 99(15): 9900-9904. ISSN: print: 0027-8424; online: 1091-6490.
NAL Call Number: 500 N21P
Abstract: The apparently rapid increase in the prevalence of amphibian limb deformities has led to substantial interest from ecologists and public health professionals. Hypotheses proposed to explain the deformities fall into two broad categories: chemical contaminants and trematode infection. Although there are convincing experimental demonstrations that certain factors can lead to some deformities, the causes for recent increases in amphibian malformation remain controversial. Moreover, no experimental studies on amphibian deformities have been conducted in the field, and no studies have attempted to examine the synergistic effects

of trematode infection and exposure to chemical contaminants. Here, I present the results of field and laboratory experiments that link increased trematode infection, and increased limb deformities, to pesticide exposure. Field experiments conclusively demonstrated that exposure to trematode infection was required for the development of limb deformities in wood frogs, *Rana sylvatica*. However, deformities were more common at sites adjacent to agricultural runoff. Laboratory experiments corroborated the association between pesticide exposure and increased infection with pesticide-mediated immunocompetency as the apparent mechanism. Given the conservative contaminant exposure levels used [Environmental Protection Agency (EPA) drinking water standards] and the widespread use of many pesticides, these negative impacts may help to explain pathogen-mediated amphibian declines in many regions.
Descriptors: wood frogs, Rana, trematode infections , Trematoda, water pollution, ponds, runoff, agricultural land, pesticide residues, organochlorine pesticides, organophosphorus pesticides, atrazine, esfenvalerate, limbs (animal), deformities, ribeiroia, telorchis, Pennsylvania.

Kirin, D. and G. Buchvarov (2002). **Biodiversity of the helminths communities of acaudated amphibians (Amphibia - Ecaudata) from Bistritsa riverside (Gotse Delchev region).** *Experimental Pathology and Parasitology* 5(8): 13-16. ISSN: 1311-6851.
Descriptors: amphibians, helminths, biodiversity, parasites, nematodes, Bistritsa riverside, Bulgaria.

Kohn, A., S.C. Cohen, and G. Salgado Maldonado (2006). **Checklist of Monogenea parasites of freshwater and marine fishes, amphibians and reptiles from Mexico, Central America and Caribbean.** *Zootaxa* 1289: 1-114. ISSN: 1175-5326.
Descriptors: amphibians, reptilians, checklists, Monogenea parasites, fresh water, marine fishes, Mexico, Central America, Caribbean.

Kuchbaev, A.E., E.B. Shakarbaev, and I.S.H. Kucharova (2002). **Helminths of the amphibians in the Uzbekistan.** *Uzbekskii Biologicheskii Zhurnal* 1: 39-43. ISSN: 0042-1685.
Descriptors: amphibians, parasites, Digenea, Nematoda, Acanthocephala, amphibian hosts, *Bufo viridis*, *Rana ridibunda*, parasite prevalence, Uzbekistan.
Language of Text: Uzbek; Summary in English and Russian.

Kuperman, B.I., V.E. Matey, R.N. Fisher, E.L. Ervin, M.L. Warburton, L. Bakhireva, and C.A. Lehman (2004). **Parasites of the African clawed frog, *Xenopus laevis*, in Southern California, U.S.A.** *Comparative Parasitology* 71(2): 229-232. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: African clawed frog, *Xenopus laevis*, parasites, Southern California.

Kuzmin, Y., V.V. Tkach, and D.R. Brooks (2007). **Two new species of *Rhabdias sp.* (Nematoda: Rhabdiasidae) from the marine toad, *Bufo marinus* (L.) (Lissamphibia: Anura: Bufonidae), in Central America.** *Journal of Parasitology.* 93(1): 159-165. ISSN: 0022-3395.
Abstract: Two new *Rhabdias* species are described from the lungs of the cane toad *Bufo marinus* (L.) from Costa Rica and Nicaragua. *Rhabdias alabialis* n. sp. differs from other

known species of the genus by the remarkable morphology of its head end, i.e., the absence of lips or pseudolabia, the slitlike oral opening, and the triangular shape of the buccal capsule in apical view. *Rhabdias pseudosphaerocephala* n. sp. is identified as a form previously known in Central and South America as *Rhabdias sphaerocephala Goodey*, 1924, a species initially described from toads in Europe. The new species is differentiated from *R. sphaerocephala* based on head-end morphology and sequences of nuclear rDNA.
Descriptors: amphibians, *Bufo marinus*, parasitology, *Rhabditida* infections, rhabditoidea classification, DNA, helminth chemistry, lung parasitology, microscopy, polymerase chain reaction, rhabditoidea anatomy, histology, genetics, ultrastructure, Costa Rica, Nicaragua.

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
Descriptors: amphibians, nematode, genus *Rhabdias*, reptiles, Nearctic.

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.*

Lopez, L.C.S., D.A. Goncalves, A. Mantovani, and R.I. Rios (2002). ***Bromeliad ostracods* pass through amphibian (*Scinaxax perpusillus*) and mammalian guts alive.** *Hydrobiologia* 485: 209-211. ISSN: 0018-8158.
Descriptors: amphibians, tadpoles, digestive tract, *Scinax perpusillus*, *Bromeliad ostracods*, pass through gut unharmed.

Luque, J.L., A.N. Martins, and L.E.R. Tavares (2005). **Community structure of metazoan parasites of the yellow Cururu toad, *Bufo ictericus* (Anura, Bufonidae) from Rio de Janeiro, Brazil**. *Acta Parasitologica* 50(3): 215-220. ISSN: 1230-2821.
NAL Call Number: QL757.A27
Descriptors: amphibians, *Bufo ictericus*, toad, metazoan parasites, community structure, nematodes, digeneans, Brazil.

McAllister, C.T. and C.R. Bursey (2005). **Endoparasites of the eastern narrowmouth toad, *Gastrophryne carolinensis* (Anura: Microhylidae), from Northwestern Louisiana and Northeastern Texas, U.S.A**. *Comparative Parasitology* 72(1): 124-128. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: amphibians, narrowmouth toad, *Gastrophryne carolinensis*, endoparasites, nematode, protozoan, Texas, Louisiana, USA.

McAllister, C.T. and C.R. Bursey (2004). **Endoparasites of the dark-sided salamander, *Eurycea longicauda melanopleura*, and the cave salamander, *Eurycea lucifuga* (Caudata: Plethodontidae), from two caves in Arkansas, U.S.A.** *Comparative Parasitology* 71(1): 61-66. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: amphibians, dark sided salamander, *Eurycea longicauda melanopleura*, cave salamander, *Eurycea lucifuga*, endoparasites, caves, Arkansas, USA.

Mcallister, C.T. and C.R. Bursey (2003). ***Bothriocephalus rarus* (Cestoidea: Pseudophyllidea) from the dwarf salamander, *Eurycea quadridigitata* (Amphibia: Caudata), in southern Arkansas, with a review of this tapeworm species in other salamander hosts.** *Texas Journal of Science* 55(3): 277-281. ISSN: 0040-4403.
NAL Call Number: 470 T31
Descriptors: amphibians, salamander, *Eurycea quadridigitata*, tapeworm, hosts, *Bothriocephalus rarus*, cestode, Arkansas, USA.

McAllister, C.T., C.R. Bursey, S.E. Trauth, and D.B. Fenolio (2006). **Helminth parasites of the grotto salamander, *Eurycea spelaea* (Caudata: Plethodontidae), from Northern Arkansas and Southern Missouri, U.S.A.** *Comparative Parasitology* 73(2): 291-297. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: amphibians, grotto salamander , *Eurycea spelaea*, helminth parasites, larvae, trematode, cestode, Arkansas, Missouri, USA.

Merila, J. and M. Sterner (2002). **Medicinal leeches (*hirudo medicinalis*) attacking and killing adult amphibians.** *Annales Zoologici Fennici* 39(4): 343-346. ISSN: 0003-455X.
NAL Call Number: 410 AN712
Descriptors: amphibians, parasites, medicinal leeches, *Hirudo medicinalis*, attacking, killing, adult amphibians.

Mitchell, J.C. (2004). **Occurrence of intradermal mite, *Hannemania* sp. (Acarina: Trombiculidae), parasites in two species of amphibians in Virginia.** *Banisteria* 23: 50-51. ISSN: 1066-0712.
Descriptors: amphibians, parasites, intradermal mite, *Hannemania* sp., Acarina, Trombiculidae, Virginia.

Perez Ponce De Leon, G., L. Garcia Prieto, and U. Razo Mendivil (2002). **Species richness of helminth parasites in Mexican amphibians and reptiles.** *Diversity and Distributions* 8(4): 211-218. ISSN: 1366-9516.
NAL Call Number: QH75.A1B573
Descriptors: amphibians, parasites, platyhelminthes, Nematoda, Hirudinea , Acanthocephala, literature review, amphibian hosts, reptilian hosts, parasite diversity, amphibian and reptilian hosts, review, Mexico.

Pessier, A.P. (2002). **An overview of amphibian skin disease.** *Seminars in Avian and Exotic Pet Medicine* 11(3): 162-174. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: amphibians, skin diseases, overview, parasites.

Poly, W.J. (2003). ***Argulus ambystoma*, a new species parasitic on the salamander *Ambystoma dumerilii* from Mexico (Crustacea: Branchiura: Argulidae).** *Ohio Journal of Science* 103(3): 52-61. ISSN: 0030-0950.
NAL Call Number: 410 Oh3
Descriptors: amphibians, salamander, *Argulus*, parasite, new species, *Argulus ambystoma*, *Ambystoma dumerilii Duges*, diagnostic characters, Mexico, dorsal pore.

Pritchett, K.R. and G.E. Sanders (2007). **Epistylididae ectoparasites in a colony of African clawed frogs (*Xenopus laevis*).** *Journal of the American Association for Laboratory Animal Science* 46(2): 86-91. ISSN: 1559-6109.
NAL Call Number: SF405.3.A23
Abstract: This report describes the discovery and treatment of a multiagent infection in a captive colony of adult, female *Xenopus laevis*. Animals were determined to be infected with *Saprolegnia* sp, a relatively common fungal parasite in laboratory-housed frogs, and a less common ectoparasite, *Epistylis* sp, that had been described only once before in frogs. We discuss the diagnosis, pathology, and treatment of *Epistylis* and the importance of water-quality monitoring and husbandry in the care of these research animals.
Descriptors: amphibians, African clawed frogs, ectoparasites, *Epistylis*, fungal parasite, *Saprolegnia*, laboratory housed frogs, diagnosis, patholgy, treatment.

Puga, S. and J.R. Formas (2005). ***Ophiotaenia calamensis*, a new species of proteocephalid tapeworm from the Andean aquatic frog *Telmatobius dankoi* (Leptodactylidae).** *Proceedings of the Biological Society of Washington* 118(2): 245-250. ISSN: 0006-324X.
NAL Call Number: 500 W272
Descriptors: aquatic frog, *Telmatobius dankoi*, parasites, tapeworm , *Ophiotaenia calamensis*, proteocephalid, new species.

Raffel, T.R., J.R. Dillard, and P.J. Hudson (2006). **Field evidence for leech-borne transmission of amphibian *Ichthyophonus* sp.** *Journal of Parasitology* 92(6): 1256-1264. ISSN: 0022-3395.
Descriptors: amphibians, infection, *Ichthyophonus* infection, leech borne, fungal disease, transmission.

Ragoo, R.M. and I.R. Omah Maharaj (2003). **Helminths of the cane toad *Bufo marinus* from Trinidad, West Indies.** *Caribbean Journal of Science* 39(2): 242-245. ISSN: 0008-6452.
Descriptors: cane toad, *Bufo marinus*, helminths, parasites, Trinidad, West Indies.

Schotthoefer, A.M., A.V. Koehler, C.U. Meteyer, and R.A. Cole (2003). **Influence of *Ribeiroia ondatrae* (Trematoda: Digenea) infection on limb development and survival of northern leopard frogs (*Rana pipiens*): Effects of host stage and parasite-exposure level.** *Canadian Journal of Zoology* 81(7): 1144-1153. ISSN: 0008-4301.

NAL Call Number: 470 C16D
Descriptors: northern leopard frogs, *Rana pipiens*, limb development, parasites, *Ribeiroia ondatrae*, limb development and survival, effect of host stage and parasite exposure level.
Language of Text: English; French.

Shazly, M.A.A. (2003). **Erythrocytic and merogonic stages of *Hepatozoon ridibundae* sp. nov. infecting the Arabian ranid frogs, *Rana ridibunda* in Saudi Arabia with reflections on the hemogregarine complex.** *Journal of the Egyptian Society of Parasitology* 33(2): 497-516. ISSN: 1110-0583.
NAL Call Number: QL757.J65
Descriptors: ranid frogs, *Rana ridibunda*, amphibians, *Hepatozoon ridibundae* species, erythrocytic, merogonic, stages, haemogregarine complex, parasites, Saudi Arabia.

Shimalov, V.V. (2002). **The helminth fauna of amphibians of open channels in meliorated regions of the Belorussian Polesie.** *Parazitologiya* 36(4): 304-309. ISSN: 0031-1847.
NAL Call Number: QL757.A1P32
Descriptors: amphibians, helminth fauna, parasites, Belorussian Polesie, Russia.
Language of Text: Russian; Summary in English and Russian.

Smales, L.R. (2005). **Acanthocephalans from some frogs and toads (Anura) and chameleons (Squamata) from Tanzania with the description of a new species.** *Journal of Parasitology* 91(6): 1459-1464. ISSN: 0022-3395.
Descriptors: frogs, toads, chameleons, Acanthocephalans, hosts, anura, Tanzania.

Smith, K.G. (2007). **Use of quantitative PCR assay for amphibian chytrid detection: Comment on Kriger et al. (2006a,b).** *Diseases of Aquatic Organisms* 73(3): 253-255. ISSN: print: 0177-5103; online: 1616-1580.
Descriptors: amphibians, parasitology, chytridiomycota, isolation, purification, mycoses, assay, polymerase chain reaction, chytridiomycota genetics, diagnosis, spores, fungal isolation.
Notes: Comment On: Dis Aquat Organ. 2006 Jul 25;71(2):141-8.

Stopper, G.F., L. Hecker, R.A. Franssen, and S.K. Sessions (2002). **How trematodes cause limb deformities in amphibians.** *Journal of Experimental Zoology* 294(3): 252-263. ISSN: 0022-104X.
NAL Call Number: 410 J825
Descriptors: amphibians, Rana, trematodes, limb deformities, cause, parasites, cysts, life cycle.

Sutherland, D. (2005). **Parasites of North American frogs.** In: M.J. Lannoo (Editor), *Amphibian Declines: The Conservation Status of United States Species.* University of California Press.: Berkeley, CA, p. 109-123. ISBN: 0520235924.
NAL Call Number: QL644.7 .A48 2005
Descriptors: frogs, parasites, diseases, North America.

Tkach, V.V., Y. Kuzmin, and E.E. Pulis (2006). **A new species of *Rhabdias* from lungs of the wood frog, *Rana sylvatica*, in North America: The last sibling of *Rhabdias ranae*?** *Journal of Parasitology.* 92(3): 631-636. ISSN: 0022-3395.
Descriptors: wood frog , *Rana pipiens*, nematodes, parasites, *Rhabdias bakeri*, lungs, new species.

Veena Tandon, R. Imkongwapang, and P.K. Prasad (2005). **On two new species of the trematode genera, *Opisthioparorchis* Wang, 1980 and *Batrachotrema* Dollfus and Williams, 1966 (Batrachotrematidae), with a report of a Chinese species of *Opisthioparorchis* from anuran amphibian hosts in India**. *Zoos' Print* 20(6): 1883-1887. ISSN: print: 0971-6378; online: 0973-2543.
Descriptors: amphibians, frogs, trematode genera, anuran, two new species, *Opisthioparorchis*, *Batrachotrema*, India.

Whitehouse, C.A. (2002). **A study of the frog lung fluke *Haematoloechus* (Trematoda: Haematoloechidae) collected from areas of Kentucky and Indiana.** *Proceedings of the Indiana Academy of Science* 111(1): 67-76. ISSN: 0073-6767.
NAL Call Number: 500 IN2
Descriptors: amphibians, frogs, toads, *Rana*, *Haematoloechus*, lung fluke, study, parasite morphology, Indiana, Kentucky, USA.

Wilson, W.D., P.T.J. Johnson, D.R. Sutherland, H. Mone, and E.S. Loker (2005). **A molecular phylogenetic study of the genus *Ribeiroia* (Digenea): Trematodes known to cause limb malformations in amphibians.** *Journal of Parasitology* 91(5): 1040-1045. ISSN: 0022-3395.
NAL Call Number: 448.8 J824
Descriptors: amphibians, *Ribeiroia*, limb malformations , trematodes, cause of malformations, molecular phylogenetic study.

Wohltmann, A., J. Koehler, and P. Martin (2006). **Endoparasitic mite infections of anuran amphibians from bolivian montane rain forests, with descriptions of two new *Hannemania* species (Acari : Parasitengona : Trombiculidae : Leeuwenhoekiinae)**. *Organisms Diversity and Evolution* 6(2): 141-150. ISSN: 1439-6092.
Descriptors: amphibians, parasites, mite infections, endoparasitc, anuran, new *Hannemania* species, chiggers, Bufonidae, Leptodactylidae.

Xiao, W.H., J.G. Wang, and L.X. Li (2002). **Taxonomic studies of parasitic nyctotherans from Chinese Anura amphibians III. *Wichtermania*.** *Zoological Studies* 41(1): 69-76. ISSN: 1021-5506.
NAL Call Number: QL307.2.C54
Descriptors: amphibians, *Rana spinosa*, *Wichtermania granuliformis*, *Wichtermania reticulatis*, (heterotrichida), amphibian hosts, Guangxi Zhuang, new species from amphibian host, China.
Language of Text: Chinese; English.

Yildirimhan, H.S., C.R. Bursey, and S.R. Goldberg (2006). **Helminth parasites of the Taurus frog, *Rana holtzi*, and the Uludag frog, *Rana macrocnemis*, with remarks on the helminth community of Turkish Anurans.** *Comparative Parasitology* 73(2): 237-248. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: Amphibians, Taurus frog, *Rana holtzi*, Uludag frog, *Rana macrocnemis*, helminth parasites, *Polystoma macrocnemis*, *Acanthocephalus ranae*, hosts, Turkey.

Yildirimhan, H.S., S.R. Goldberg, and C.R. Bursey (2006). **Helminth parasites of the banded frog *Rana camerani* (Ranidae) from Turkey.** *Comparative Parasitology* 73(2): 222-236. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: amphibians, banded frog, *Rana camerani*, helminth parasites, Turkey.

Yildirimhan, H.S., F.N. Altunel, and I.H. Ugurtas (2006). **Bursa, Edirne ve Sakarya'dan toplanan *Hyla arborea* (Linnaeus, 1758) (agac kurbagasi)'nin helmint parazitleri. [Helminth parasites of *Hyla arborea* (Linnaeus, 1758) (tree frog) collected from Bursa, Edirne and Sakarya.]**. *Turkiye Parazitoloji Dergisi* 30(1): 56-58. ISSN: 1300-6320.
Descriptors: amphibians, tree frog, *Hyla arborea*, helminth parasites, Turkey.
Language of Text: Turkish; Summary in English and Turkish.

Yildirimhan, H.S. and E. Karadeniz (2007). **Helminth parasites of the common toad, *Bufo bufo* (linnaeus, 1758) (Anura : Bufonidae) from northeast Turkey**. *Comparative Parasitology* 74(1): 176-178. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: amphibians, toad, *Bufo bufo*, helminth parasites, nematoda, acanthocephala, Turkey.

Yldrmhan, H.S., C.R. Bursey, and S.R. Goldberg (2005). **Helminth parasites of the Caucasian salamander, *Mertensiella caucasica*, from Turkey**. *Comparative Parasitology* 72(1): 75-87. ISSN: 1525-2647.
NAL Call Number: QL392.J68
Descriptors: amphibians, Caucasian salamander, *Mertensiella caucasica* , helminth parasites, Digenea, Cestoda, Nematoda, Monogenea, Acanthcephala, Turkey.

Yoshikawa, H., K. Morimoto, M. Nagashima, and N. Miyamoto (2004). **A survey of Blastocystis infection in anuran and urodele amphibians.** *Veterinary Parasitology* 122(2): 91-102. ISSN: 0304-4017.
NAL Call Number: SF810.V4
Abstract: Blastocystis infection in amphibians was surveyed in three species of anuran and one species of urodele amphibians captured at two distinct locations in Japan. All three species of frogs were highly infected with Blastocystis, while 69 individual urodele newts, *Cynopus pyrrhogaster*, were negative for infection. Eleven Blastocystis isolates (47.8%) were recovered from 23 *Rana nigromaculata* leopard frogs. Twenty-three (92%) of 25 *Rana*

catesbeiana bullfrogs and all (100%) of 24 *Bufo japonicus japonicus* toads were positive for Blastocystis. Two distinct populations of the toad and bullfrog showed a high prevalence (100 or 84.6%) of Blastocystis infection, while in two populations of the leopard frog only one population was positive for Blastocystis (84.6%). Three Blastocystis isolates from different species of the frogs were established. Since none of the three isolates could survive at 37 degrees C, a temperature tolerance assay was performed to assess the optimal growth temperature and to determine the range of non-lethal temperatures. During the exponential growth phase of 3- or 4-day cultures at 25 degrees C, three isolates were exposed to 4, 28, 31, or 34 degrees C for 3 days and then returned to 25 degrees C to monitor the cell growth. Based on the optimal growth temperatures and different ranges of temperature tolerance among the three new isolates from frogs and two known species, *Blastocystis hominis* and *Blastocystis lapemi*, it was established that the three isolates recovered from different species of frogs had different physiological features from *B. hominis* and *B. lapemi.*

Descriptors: amphibians, frogs, newts, toads, anuran, urodele, Blastocystis, infection, parasites, temperature tolerance assay, optimal growth temperature.

Zickus, T. (2002). **The first data on the fauna and distribution of blood parasites of amphibians in Lithuania.** *Acta Zoologica Lituanica* 12(2): 197-202. ISSN: 1392-1657.

Descriptors: amphibians, frogs, anura, Rana, Bufo, blood parasites, fauna, distribution, Lithuania.

Language of Text: English; Lithuanian.

Regeneration

Ali, R.A., A.W.A. El Ghareeb, and H. Hamdy (2004). **Hormonal control in regeneration: IV- thyroxine failed to enhance limb regeneration in metamorphic stages of the Egyptian toad, *Bufo regularis* Reuss.** *Journal of Union of Arab Biologists Cairo A Zoology* 22: 229-252. ISSN: 1110-5372.
Descriptors: toad, *Bufo regularis*, limb regeneration, hormonal control, thyroxine, thyroxine, metamorphic stages.
Language of Text: Arabic; English.

Ali, R.A., A.W.A. El Ghareeb, and H. Hamdy (2005). **Hormonal control in regeneration: VI - growth hormone enhances limb regeneration in metamorphic stages of the Egyptian toad, *Bufo regularis* Reuss.** *Journal of the Egyptian German Society of Zoology* 47(B): 29-48 . ISSN: 1110-5356.
NAL Call Number: QL1.E49
Descriptors: toad, *Bufo regularis*, limb regeneration, growth hormone, enhances limb regeneration, effects, metamorphic stages.
Language of Text: Arabic; English.

Araki, M. (2007). **Regeneration of the amphibian retina: Role of tissue interaction and related signaling molecules on RPE transdifferentiation.** *Development Growth and Differentiation.* 49(2): 109-120. ISSN: 0012-1592.
Abstract: Regeneration of eye tissue is one of the classic subjects in developmental biology and it is now being vigorously studied to reveal the cellular and molecular mechanisms involved. Although many experimental animal models have been studied, there may be a common basic mechanism that governs retinal regeneration. This can also control ocular development, suggesting the existence of a common principle between the development and regeneration of eye tissues. This notion is now becoming more widely accepted by recent studies on the genetic regulation of ocular development. Retinal regeneration can take place in a variety of vertebrates including fish, amphibians and birds. The newt, however, has been considered to be the sole animal that can regenerate the whole retina after the complete removal of the retina. We recently discovered that the anuran amphibian also retains a similar ability in the mature stage, suggesting the possibility that such a potential could be found in other animal species. In the present review article, retinal regeneration of amphibians (the newt and *Xenopus laevis*) and avian embryos are described, with a particular focus on transdifferentiation of retinal pigmented epithelium. One of the recent progresses in this field is the availability of tissue culture methods to analyze the initial process of transdifferentiation, and this enables us to compare the proliferation and neural differentiation of retinal pigmented epithelial cells from various animal species under the same conditions. It was revealed that tissue interactions between the retinal pigmented epithelium and underlying connective tissues (the choroid) play a substantial role in transdifferentiation and that this is mediated by a diffusible signal such as fibroblast growth factor 2. We propose that tissue interaction,

particularly mesenchyme-neuroepithelial interaction, is considered to play a fundamental role both in retinal development and regeneration.
Descriptors: salamanders and newts, *Xenopus laevis*, retina-regeneration, transdifferentiation, tissue interaction, signaling molecules.

Araki, M. (2005). **Amphibian retinal regeneration - two modes of regeneration process**. *Zoological Science* 22(12): 1375. ISSN: 0289-0003.
NAL Call Number: QL1.Z68
Descriptors: amphibians, retinal regeneration, sense organs, *Xenopus* metamorphosis, regeneration process, meeting.
Notes: Meeting Information: 76th Annual Meeting of the Zoological Society of Japan, Tsukuba, Japan; October 6-8, 2005.

Bach, H., V. Arango, D. Feldheim, J.G. Flanagan, and F. Scalia (2004). **Fiber order of the normal and regenerated optic tract of the frog (*Rana pipiens*)**. *Journal of Comparative Neurology* 477(1): 43-54. ISSN: 0021-9967.
Descriptors: amphibians, frog, *Rana pipiens*, optic tract, fiber order, normal, regenerated, retina , axons, regeneration.

Brockes, J.P. (2006). **Positional identity of adult limb stem cells during regeneration in salamanders**. *Journal of Anatomy* 209(4): 565-566. ISSN: 0021-8782.
Descriptors: amphibians, salamanders, regeneration, adult limb stem cells, positional identity, meeting.
Notes: Meeting Information: Fall Meeting of the Anatomical Society of Great Britain and Ireland, Oxford, UK; January 4 -6, 2006.

Brockes, J.P. and A. Kumar (2002). **Plasticity and reprogramming of differentiated cells in amphibian regeneration**. *Nature Reviews. Molecular Cell Biology* 3(8): 566-574. ISSN: 1471-0072.
Descriptors: amphibians, regeneration, reprogramming, differentiated cells, plasticity.

Carlson, B.M. (2003). **Muscle regeneration in amphibians and mammals: passing the torch.** *Developmental Dynamics* 226(2): 167-181. ISSN: 1058-8388.
NAL Call Number: QL801.A4
Descriptors: amphibians, muscle regeneration, mammals.

Chang, W.Y., F. Khosrowshahian, M. Wolanski, R. Marshall, W. McCormick, S. Perry, and M.J. Crawford (2006). **Conservation of Pitx1 expression during amphibian limb morphogenesis.** *Biochemistry and Cell Biology* 84(2): 257-262. ISSN: 1208-6002.
Abstract: In contrast to the pattern of limb emergence in mammals, chicks, and the newt *N. viridescens*, embryos such as *Xenopus laevis* and *Eleutherodactylus coqui* initiate pelvic limb buds before they develop pectoral ones. We studied the expression of Pitx1 in *X. laevis* and *E. coqui* to determine if this paired-like homeodomain transcription factor directs differentiation specifically of the hindlimb, or if it directs the second pair of limbs to form, namely the forelimbs. We also undertook to determine if embryonic expression patterns were reca-

pitulated during the regeneration of an amputated limb bud. Pitx1 is expressed in hindlimbs in both *X. laevis* and *E. coqui*, and expression is similar in both developing and regenerating limb buds. Expression in hindlimbs is restricted to regions of proliferating mesenchyme.
Descriptors: frogs, anuran embryology, anuran genetics, *Xenopus laevi*s proteins, genetics, embryology, anuran growth, development, physiology, gene expression regulation, developmental, genes, hindlimb embryology, growth, development, hindlimb physiology, regeneration, species specificity.

Chevallier, S., M. Landry, F. Nagy, and J.M. Cabelguen (2004). **Recovery of bimodal locomotion in the spinal-transected salamander, *Pleurodeles waltlii*.** *European Journal of Neuroscience* 20(8): 1995-2007. ISSN: print: 0953-816X; online: 1460-9568.
Abstract: Electromyographic (EMG) analysis was used to provide an assessment of the recovery of locomotion in spinal-transected adult salamanders (*Pleurodeles waltlii*). EMG recordings were performed during swimming and overground stepping in the same animal before and at various times (up to 500 days) after a mid-trunk spinalization. Two-three weeks after spinalization, locomotor EMG activity was limited to the forelimbs and the body rostral to the transection. Thereafter, there was a return of the locomotor EMG activity at progressively more caudal levels below the transection. The animals reached stable locomotor patterns 3-4 months post-transection. Several locomotor parameters (cycle duration, burst duration, burst proportion, intersegmental phase lag, interlimb coupling) measured at various recovery times after spinalization were compared with those in intact animals. These comparisons revealed transient and long-term alterations in the locomotor parameters both above and below the transection site. These alterations were much more pronounced for swimming than for stepping and revealed differences in adaptive plasticity between the two locomotor networks. Recovered locomotor activity was immediately abolished by retransection at the site of the original spinalization, suggesting that the spinal cord caudal to the transection was reinnervated by descending brain and/or propriospinal axons, and that this regeneration contributed to the restoration of locomotor activity. Anatomical studies conducted in parallel further demonstrated that some of the regenerated axons came from glutamatergic and serotoninergic immunoreactive cells within the reticular formation.
Descriptors: salamander, spinal transected, bimodal locomotion, recovery, swimming, stepping, recovery, assessment, anatomical studies.

Da Silva, S.M., P.B. Gates, and J.P. Brockes (2002). **The newt ortholog of cd59 is implicated in proximodistal identity during amphibian limb regeneration**. *Developmental Cell* 3(4): 547-555. ISSN: 1534-5807.
Descriptors: amphibians, limb regeneration, newt, cd59, orthlog, proximodistal identity, orthlog, blastema, retinoic acid.

Dunlop, S.A., M. Tennant, and L.D. Beazley (2002). **Extent of retinal ganglion cell death in the frog *Litoria moorei* after optic nerve regeneration induced by lesions of different sizes.** *Journal of Comparative Neurology* 446(3): 276-287. ISSN: 0021-9967.
Descriptors: frog, *Litoria moorei*, nerves, optic nerve regeneration, eye, retinal ganglion cell death during optic nerve regeneration, development.

El Esawi, M.A. and K.A. Farag (2006). **Restoration of the regenerative capacity of the hind limbs after transaction at the middle thigh level during the metamorphosis climactic stage (57) of the toad *Bufo regularis* Reuss.** *Journal of the Egyptian German Society of Zoology* 51(A): 487-505. ISSN: 1110-5356.
NAL Call Number: QL1.E49
Descriptors: toad, *Bufo regularis*, regenerative capacity, hind limbs, transaction, middle high level.
Language of Text: Arabic; English.

Endo, T., J. Yoshino, K. Kado, and S. Tochinai (2007). **Brain regeneration in anuran amphibians.** *Development Growth and Differentiation* 49(2): 121-129. ISSN: 0012-1592.
Abstract: Urodele amphibians are highly regenerative animals. After partial removal of the brain in urodeles, ependymal cells around the wound surface proliferate, differentiate into neurons and glias and finally regenerate the lost tissue. In contrast to urodeles, this type of brain regeneration is restricted only to the larval stages in anuran amphibians (frogs). In adult frogs, whereas ependymal cells proliferate in response to brain injury, they cannot migrate and close the wound surface, resulting in the failure of regeneration. Therefore frogs, in particular *Xenopus*, provide us with at least two modes to study brain regeneration. One is to study normal regeneration by using regenerative larvae. In this type of study, the requirement of reconnection between a regenerating brain and sensory neurons was demonstrated. Functional restoration of a regenerated telencephalon was also easily evaluated because *Xenopus* shows simple responses to the stimulus of a food odor. The other mode is to compare regenerative larvae and non-regenerative adults. By using this mode, it is suggested that there are regeneration-competent cells even in the non-regenerative adult brain, and that immobility of those cells might cause the failure of regeneration. Here we review studies that have led to these conclusions.
Descriptors: amphibians, frog, *Xenopus*, anuran, Urodele amphibians, brain regeneration, brain injury, ependymal cells.

Fahmy, G.H. and R.E. Sicard (2002). **A role for effectors of cellular immunity in epimorphic regeneration of amphibian limbs**. *In Vivo* 16(3): 179-184. ISSN: 0258-851X.
Descriptors: amphibians, epimorphic regeneration of limbs, cellular immunity, effectors, role, suppression, skin allografts.

Gardiner, D.M., T. Endo, and S.V. Bryant (2002). **The molecular basis of amphibian limb regeneration: integrating the old with the new.** *Seminars in Cell and Developmental Biology* 13(5): 345-352. ISSN: 1084-9521.
Descriptors: amphibians, limb regeneration, molecular basis, review.

Girvan, J.E., W.M. Olson, and B.K. Hall (2002). **Hind-limb regeneration in the dwarf African clawed frog, *Hymenochirus boettgeri* (Anura: Pipidae).** *Journal of Herpetology* 36(4): 537-543. ISSN: 0022-1511.
NAL Call Number: QL640.J6

Descriptors: dwarf African clawed frog, *Hymenochirus boettgeri*, hindlimbs regeneration, Anura.

Han, M.J. and W.S. Kim (2002). **Effect of retinoic acid on fgf-8 expression in regenerating urodele amphibian limbs.** *Korean Journal of Biological Sciences* 6(4): 301-304. ISSN: 1226-5071.
Descriptors: amphibians, limbs, regenerating, urodele, retinoic acid, fgf-8, effect, mesenchymal tissue, epidermal tissue, salamander.

Ishizuya Oka, A. (2007). **Regeneration of the amphibian intestinal epithelium under the control of stem cell niche.** *Development Growth and Differentiation* 49(2): 99-107. ISSN: 0012-1592.
Abstract: The epithelium of the mammalian digestive tract originates from stem cells and undergoes rapid cell-renewal throughout adulthood. It has been proposed that the microenvironment around the stem cells, called 'niche', plays an important role in epithelial cell-renewal through cell-cell and cell-extracellular matrix interactions. The amphibian intestine, which establishes epithelial cell-renewal during metamorphosis, serves as a unique and good model for studying molecular mechanisms of the stem cell niche. By using the organ culture of the *Xenopus laevis* intestine, we have previously shown that larval-to-adult epithelial remodeling can be organ-autonomously induced by thyroid hormone (TH) and needs interactions with the surrounding connective tissue. Thus, in this animal model, the functional analysis of TH response genes is useful for clarifying the epithelial-connective tissue interactions essential for intestinal remodeling at the molecular level. Recent progress in culture and transgenic technology now enables us to investigate functions of such TH response genes in the *X. laevis* intestine and sheds light on molecular aspects of the stem cell niche that are common to the mammalian intestine.
Descriptors: amphibian, *Xenopus laevis* intestine, bone morphogenetic protein 4, intestinal remodeling, sonic hedgehog, stem cell niche, thyroid hormone, regeneration, amphibian.

Karapetian, A.F. and K.A. Dzhivanian (2006). **[Liver regenerative potential of the lake frog *Rana ridibunda* after partial hepatectomy]**. *Tsitologiia* 48(4): 346-354. ISSN: 0041-3771.
Abstract: A histomorphological study of the regenerating liver of *Rana ridibunda*, within 2 months after partial hepatectomy, shows that regenerative processes on the wound surface are slowly proceeding. Processes of reticular fiber reconstruction occurred in the composition of the basal membrane of liver sinusoids. A cytophotometric study shows that glandular cells in *R. ridibunda* liver are commonly tetraploid. The post-traumatic regeneration of the liver after partial hepatectomy involves activation of DNA synthesis in hepatocytes, leading to increase in their ploidy. Within the 1st month of regeneration, the mitotic index of hepatocytes substantially increased. Regeneration of glandular parenchyma of the liver is accompanied by a quantitative increase in binucleate hepatocytes, which is most highly expressed within 5-20 days after partial hepatectomy.
Descriptors: lake frog, *Rana ridibunda*, liver cytology, liver physiology, liver regeneration, physiology, cell nucleus ultrastructure, cytophotometry, hepatectomy, hepatocytes cytology,

mitotic index, ploidies, reticulin, time factors.
Language of Text: Russian.

Mescher, A.L. and A.W. Neff (2006). **Limb regeneration in amphibians: immunological considerations**. *The Scientific World Journal* 6: 1-11. ISSN: 1537-744X.
Descriptors: amphibians, urodele, anuran, limb regeneration, immunological considerations, nerves, regenerative capacity.

Monaghan, J.R., J.A. Walker, R.B. Page, S. Putta, C.K. Beachy, and S.R. Voss (2007). **Early gene expression during natural spinal cord regeneration in the salamander *Ambystoma mexicanum*.** *Journal of Neurochemistry* 101(1): 27-40. ISSN: 0022-3042.
Descriptors: amphibians, salamander, *Ambystoma mexicanum*, early gene expression, natural spinal cord regeneration, tail amputation.

Morrison, J.I., S. Loof, P. He, and A. Simon (2006). **Salamander limb regeneration involves the activation of a multipotent skeletal muscle satellite cell population.** *Journal of Cell Biology* 172(3): 433-440. ISSN: 0021-9525.
Online: http://dx.doi.org/10.1083/jcb.200509011
NAL Call Number: 442.8 J828
Abstract: In contrast to mammals, salamanders can regenerate complex structures after injury, including entire limbs. A central question is whether the generation of progenitor cells during limb regeneration and mammalian tissue repair occur via separate or overlapping mechanisms. Limb regeneration depends on the formation of a blastema, from which the new appendage develops. Dedifferentiation of stump tissues, such as skeletal muscle, precedes blastema formation, but it was not known whether dedifferentiation involves stem cell activation. We describe a multipotent Pax7 superscript + satellite cell population located within the skeletal muscle of the salamander limb. We demonstrate that skeletal muscle dedifferentiation involves satellite cell activation and that these cells can contribute to new limb tissues. Activation of salamander satellite cells occurs in an analogous manner to how the mammalian myofiber mobilizes stem cells during skeletal muscle tissue repair. Thus, limb regeneration and mammalian tissue repair share common cellular and molecular programs. Our findings also identify satellite cells as potential targets in promoting mammalian blastema formation.
Descriptors: salamander, limb regeneration, satellite cell population , skeletal muscle, blastema formation, tissue repair.

Satoh, A., T. Endo, M. Abe, N. Yakushiji, S. Ohgo, K. Tamura, and H. Ide (2006). **Characterization of *Xenopus* digits and regenerated limbs of the froglet**. *Developmental Dynamics* 235(12): 3316-3326. ISSN: 1058-8388.
NAL Call Number: QL801.A4
Descriptors: amphibians, froglet, *Xenopus*, regenerated limbs, characterization, digits.

Shimizu Nishikawa, K., J. Takahashi, and A. Nishikawa (2003). **Intercalary and supernumerary regeneration in the limbs of the frog, *Xenopus laevis*.** *Developmental Dynamics* 227(4): 563-572. ISSN: 1058-8388.

NAL Call Number: QL801.A4
Descriptors: amphibians, frog, tadpoles, *Xenopus laevis*, regeneration, limbs, intercalary, supernumerary, anuran, urodele.

Slack, J.M. (2006). **Amphibian muscle regeneration--dedifferentiation or satellite cells?** *Trends in Cell Biology* 16(6): 273-275. ISSN: 0962-8924.
NAL Call Number: QH573.T73
Abstract: Until recently, the cell biology of mammalian muscle repair following damage appeared to be completely different from the formation of new muscles in regenerated appendages of Amphibia. Mammalian muscle repair occurs through the mobilization of muscle satellite cells, whereas the new muscle in amphibian appendage regeneration was believed to arise by dedifferentiation of myofibres to form myoblasts. But recent work shows that muscle satellite cells are also involved in amphibian regeneration and the controversy about the reality of muscle dedifferentiation is heating up again.
Descriptors: amphibia physiology, muscles physiopathology, regeneration physiology, satellite cells, skeletal muscle physiology, cell differentiation, myoblasts physiology, wound healing.

Stocum, D.L. (2004). **Amphibian regeneration and stem cells.** *Current Topics in Microbiology and Immunology* 280: 1-70. ISSN: 0070-217X.
Abstract: Larval and adult urodeles and anuran tadpoles readily regenerate their limbs via a process of histolysis and dedifferentiation of mature cells local to the amputation surface that accumulate under the wound epithelium as a blastema of stem cells. These stem cells require growth and trophic factors from the apical epidermal cap (AEC) and the nerves that re-innervate the blastema for their survival and proliferation. Members of the fibroblast growth factor (FGF) family synthesized by both AEC and nerves, and glial growth factor, substance P, and transferrin of nerves are suspected survival and proliferation factors. Stem cells derived from fibroblasts and muscle cells can transdifferentiate into other cell types during regeneration. The regeneration blastema is a self-organizing system based on positional information inherited from parent limb cells. Retinoids, which act through nuclear receptors, have been used in conjunction with assays for cell adhesivity to show that positional identity of blastema cells is encoded in the cell surface. These molecules are involved in the cell-cell signaling network that re-establishes the original structural pattern of the limb. Other systems of interest that regenerate by histolysis and dedifferentiation of pigmented epithelial cells are the neural retina and lens. Members of the FGF family are also important to the regeneration of these structures. The mechanism of amphibian regeneration by dedifferentiation is of importance to the development of a regenerative medicine, since understanding this mechanism may offer insights into how we might chemically induce the regeneration of mammalian tissues.
Descriptors: amphibians, regeneration, stem cells, anurans.

Straube, W.L. and E.M. Tanaka (2006). **Reversibility of the differentiated state: regeneration in amphibians**. *Artificial Organs* 30(10): 743-755. ISSN: 0160-564X.
Descriptors: amphibians, regeneration, differentiated state, reversibility, organs, body structures.

Suzuki, M., N. Yakushiji, Y. Nakada, A. Satoh, H. Ide, and K. Tamura (2006). **Limb regeneration in *Xenopus laevis* froglet**. *The Scientific World Journal* 6: 26-37. ISSN: 1537-744X.
Descriptors: amphibians, frog, *Xenopus laevis*, limb regeneration, froglet, epimorphosis, blastema, urodele, anuran, review.

Reproduction

Adams, S.M., J.M. Biazik, M.B. Thompson, and C.R. Murphy (2005). **Cyto-epitheliochorial placenta of the viviparous lizard *Pseudemoia entrecasteauxii*: a new placental morphotype.** *Journal of Morphology* 264(3): 264-276. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: viviparous lizard, epithelial cells ultrastructure, lizards anatomy, histology, embryo, nonmammalian, gestational age, cyto-epitheliochorial placenta.

Adler, K. (2003). **Salamander classification and reproductive biology. An historical overview.** In: D.M. Sever (Editor), *Reproductive Biology and Phylogeny of Urodela,* Reproductive Biology and Phylogeny Series, Science Publishers, Inc.: Enfield and Plymouth. p. 1-29. ISBN: 1578082854.
NAL Call Number: QL668.C2 R45 2003
Descriptors: Urodela, salamanders, history of zoology, reproductive biology and classification.

Aguiar, O., A.A. Garda, A.P. Lima, G.R. Colli, S.N. Bao, and S.M. Recco Pimentel (2003). **Biflagellate spermatozoon of the poison-dart frogs *Epipedobates femoralis* and *Colostethus* sp. (Anura, Dendrobatidae).** *Journal of Morphology* 255(1): 114-121. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: amphibians, poison dart frogs, *Epipedobates femoralis*, *Colostethus* sp., biflagellate spermatozoon , Anura.

Andersen, F. (2006). **Hold og opdraet af dvaerg-pipatudsen (*Pipa parva*). [Care and breeding of the dwarf toad (*Pipa parva*).]**. *Nordisk Herpetologisk Forening* 49(4): 139-142. ISSN: 0900-484X.
Descriptors: dwarf toad, *Pipa parva*, diet in captivity, housing techniques, terrarium conditions, rearing techniques, terrarium conditions, diet significance, reproductive techniques, breeding techniques.
Language of Text: Danish; Summary in English.

Anonymous (2005). **Gene expression during frog development.** *Journal of Biological Chemistry* 280(29): e99935. ISSN: 0021-9258.
Online: http://www.jbc.org/cgi/content/full/280/29/e9993
NAL Call Number: 381 J824
Descriptors: frog, development, gene expression, embryo, reproduction.

Boegi, C., G. Levy, I. Lutz, and W. Kloas (2002). **Functional genomics and sexual differentiation in amphibians.** *Comparative Biochemistry and Physiology Part B Biochemistry and Molecular Biology* 133B(4): 559-570. ISSN: 1096-4959.

Descriptors: amphibians, *Xenopus laevis*, functional genomics, sexual differentiation, mechanism, sexual steroids, hatching, androgens, estradiol.

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.

Bramucci, M., L. Quassinti, E. Maccari, O. Murri, and D. Amici (2004). **Seasonal changes in angiotensin converting enzyme activity in male and female frogs (*Rana esculenta*).** *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 137A(3): 605-610. ISSN: 1095-6433.
Descriptors: frogs, male, female, *Rana esculenta*, angiotensin converting enzyme activity, seasonal changes.

Briggler, J.T. and W.L. Puckette (2003). **Observations on reproductive biology and brooding behavior of the Ozark zigzag salamander, *Plethodon angusticlavius*.** *Southwestern Naturalist* 48(1): 96-100. ISSN: 0038-4909.
NAL Call Number: 409.6 So8
Descriptors: amphibians, Ozark zigzag salamander, *Plethodon angusticlavius*, observations on reproductive biology, brooding behavior.
Language of Text: English; Spanish.

Browne, R.K., J. Davis, M. Pomering, and J. Clulow (2002). **Storage of cane toad (*Bufo marinus*) sperm for 6 days at 0degree C with subsequent cryopreservation.** *Reproduction, Fertility, and Development* 14(5-6): 267-273. ISSN: 1031-3613.

NAL Call Number: QP251.R47
Descriptors: cane toad, sperm, storage 6 days, cryopreservation, suspensions, macerated testes, SAR, diluents, sperm motility.

Browne, R.K., M. Mahony, and J. Clulow (2002). **A comparison of sucrose, saline, and saline with egg-yolk diluents on the cryopreservation of cane toad (*Bufo marinus*) sperm**. *Cryobiology* 44(3): 251-257. ISSN: 0011-2240.
Descriptors: amphibians, toad, *Bufo marinus*, sperm, cryopreservation, diluents, sucrose, saline, egg yolk, comparison.

Canosa, L.F. and N.R. Ceballos (2002). **Seasonal changes in testicular steroidogenesis in the toad *Bufo arenarum* H.** *General and Comparative Endocrinology* 125(3): 426-434. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: toad, *Bufo arenarum*, steroids, steroidogenesis, seasonal changes, hormones, steroid hormones, testis.

Catenazzi, A. (2006). ***Phrynopus cophites* (Cuzco Andes frog). Reproduction.** *Herpetological Review* 37(2): 206. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: amphibians, Andes frog, reproduction, egg number, clutch size.

Chan, L.M. (2003). **Seasonality, microhabitat and cryptic variation in tropical salamander reproductive cycles.** *Biological Journal of the Linnean Society* 78(4): 489-496. ISSN: 0024-4066.
NAL Call Number: QH301.B56
Descriptors: tropical salamander reproductive cycles, seasonality, microhabitat, cryptic variation, amphibians.

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.

Cobellis, G., G. Cacciola, D. Scarpa, R. Meccariello, R. Chianese, M.F. Franzoni, K. Mackie, R. Pierantoni, and S. Fasano (2006). **Endocannabinoid system in frog and rodent testis: type-1 cannabinoid receptor and fatty acid amide hydrolase activity in male germ cells.** *Biology of Reproduction* 75(1): 82-89. ISSN: 0006-3363.
Online: http://dx.doi.org/10.1095/biolreprod.106.051730
Abstract: N-arachidonoylethanolamide (anandamide [AEA]) is the main endocannabinoid described to date in the testis. It exerts its effects through the activation of G-protein coupled cannabinoid receptors (CNR). However, the activity of AEA in controlling male reproduction is still poorly known. Here we provide direct evidence on the presence of the "endocannabinoid system," constituted by type-1 cannabinoid receptor (CNR1) and fatty

acid amide hydrolase (FAAH), in the frog *Rana esculenta* testis demonstrating its expression in tubular compartment. In fact, during the annual reproductive cycle, both proteins increase in September, when the appearance of spermatids (SPT) occurs. Immunocytochemistry confirms their localization in germ cells and, in particular, in elongated SPT. Signals are still present in spermatozoa (SPZ), as demonstrated by Western blot analysis. Furthermore, the activation of CNR1 reduces sperm motility. Comparative research, carried out using mouse and rat SPZ, definitely indicates that the endocannabinoid system operates in SPZ of phylogenetically distant species. A conserved physiological role of endocannabinoid system in controlling the inhibition of sperm motility is suggested.
Descriptors: frog, *Rana esculenta*, rodent, testis, endocannabinoid dydtem, receptor, fatty acid, spermatids, germ cells.

Donna, D., E. Cottone, E. Campantico, A. Guastalla, K. Mackie, and M.F. Franzoni (2006). **Endocannabinoids and amphibian reproduction: an immunchistochemical study**. *Journal of Experimental Zoology* 305A(2): 123. ISSN: Part A: print:1548-8969; online: 1552-499X.
NAL Call Number: 410 J825
Descriptors: amphibians, reproduction, endocannabinoids, immunohistochemical study, meeting.

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 metabo-

lism, lizards growth and development, locomotion, temperature, physiological adaptation, newborn animals, embryonic development.

Edwards, D.L., M.J. Mahony, and J. Clulow (2004). **Effect of sperm concentration, medium osmolality and oocyte storage on artificial fertilisation success in a myobatrachid frog (*Limnodynastes tasmaniensis*).** *Reproduction, Fertility, and Development* 16(3): 347-354. ISSN: 1031-3613.
NAL Call Number: QP251.R47
Descriptors: amphibians, myobatrachid frog, *Limnodynastes tasmaniensis*, artificial fertilisation, oocyte storage, sperm concentration, medium osmolality, effect.

Eggert, C. (2004). **Sex determination: the amphibian models.** *Reproduction, Nutrition, Development* 44(6): 539-549. ISSN: print: 0926-5287; online: 1297-9708.
Online: http://dx.doi.org/10.1051/rnd:2004062
NAL Call Number: QL1.R35
Abstract: We review and discuss current knowledge about sex determination in amphibians. The astonishing wide variety of mechanisms of genotypic sex determination is presented and discussed in an evolutionary context. We recall the natural occurrence of transitory juvenile hermaphroditism in some species. Our present knowledge of the mechanisms of sex determination in amphibians is compared to that in mammals. The influence of epigenetic factors, and especially temperature is highlighted. In amphibians, the influence of temperature on sexual differentiation, that can prevail over genotypic sex determination, remains poorly considered in publications. We suggest that studies on genetic and epigenetic factors of gonadal sex differentiation in amphibians could provide substantial information on the evolutionary process of sex determination mechanisms in current living vertebrates.
Descriptors: amphibian genetics, hermaphroditism, sex determination genetics, genotype, hermaphroditism genetics, temperature, influence, sex differentiation genetics, testis physiology.

Ehmcke, J., G. Clemens, and H. Greven (2002-2003). **Oviductal anatomy and histology of five species of Neotropical plethodontid salamanders (Urodela, Amphibia).** *Acta Biologica Benrodis* 12(1-2): 1-17. ISSN: 0177-9214.
Descriptors: Neotropical plethodontid salamanders, amphibians, oviductal anatomy, histology, comparative study , five species, Urodela, Amphibia.
Language of Text: English; German.

Exbrayat, J.M. (2005). **Reproduction and development of *Typhlonectes compressicauda*, as a contribution to the knowledge of the biology of Gymnophiona, the least known Amphibian order.** *Recent Research Developments in Life Sciences* 3: 215-239.
Descriptors: amphibians, *Typhlonectes compressicauda*, reproduction, biology, taxonomy, order Gymnophiona.

Ferrara, D., C. Palmiero, M. Branno, R. Pierantoni, and S. Minucci (2004). **Testicular activity of mos in the frog, *Rana esculenta*: A new role in spermatogonial proliferation**. *Biology of Reproduction* 70(6): 1782-1789. ISSN: 0006-3363.
Online: http://dx.doi.org/10.1095/biolreprod.103.026666
NAL Call Number: QL876.B5
Descriptors: amphibians, frog, *Rana esculenta*, mos, testicular activity, spematogonial proliferation, MAPK, kinase, gonads.

Ficetola, G.F. and F. De Bernardi (2005). **Interspecific social interactions and breeding success of the frog *Rana latastei*: a field study.** *Ethology* 111(8): 764-774. ISSN: 0179-1613.
NAL Call Number: QL750.E74
Descriptors: amphibians, frog, *Rana latastei*, interspecific social interactions, breeding success, field study.

Fort, D.J., S. Degitz, J. Tietge, and L.W. Touart (2007). **The hypothalamic-pituitary-thyroid (HPT) axis in frogs and its role in frog development and reproduction.** *Critical Reviews in Toxicology* 37(1-2): 117-161. ISSN: print: 1040-8444; online: 1547-6898.
Abstract: Metamorphosis of the amphibian tadpole is a thyroid hormone (TH)-dependent developmental process. For this reason, the tadpole is considered to be an ideal bioassay system to identify disruption of thyroid function by environmental contaminants. Here we provide an in-depth review of the amphibian thyroid system with particular focus on the role that TH plays in metamorphosis. The amphibian thyroid system is similar to that of mammals and other tetrapods. We review the amphibian hypothalamic-pituitary-thyroid (HPT) axis, focusing on thyroid hormone synthesis, transport, and metabolism. We also discuss the molecular mechanisms of TH action, including the role of TH receptors, the actions of TH on organogenesis, and the mechanisms that underlie the pleiotropic actions of THs. Finally, we discuss methods for evaluating thyroid disruption in frogs, including potential sites of action, relevant endpoints, candidate protocols for measuring thyroid axis disruption, and current gaps in our knowledge. The utility of amphibian metamorphosis as a model for evaluating thyroid axis disruption has recently led to the development of a bioassay using *Xenopus laevis*.
Descriptors: frogs, *Xenopus laevis*, development, reproduction, hypothalamic-pituitary-thyroid, HPT, role, metamorphosis, tadpole, bioassay, thyroid function, animal model.

Giaretta, A.A. and M.N.d.C. Kokubum (2004). **Reproductive ecology of *Leptodactylus furnarius* Sazima & Bokermann, 1978, a frog that lays eggs in underground chambers (Anura: Leptodactylidae).** *Herpetozoa* 16(3-4): 115-126. ISSN: 1013-4425.
Descriptors: frog, *Leptodactylus furnarius*, reproductive ecology, lays eggs, underground chambers, Anura, amphibians.
Language of Text: English; German.

Gibson, R.C. and K.R. Buley (2004). **Maternal care and obligatory oophagy in *Leptodactylus fallax*: a new reproductive mode in frogs.** *Copeia* 2004(1): 128-135. ISSN: 0045-8511.
Descriptors: frogs, *Leptodactylus fallax*, obligatory oophagy, developing larvae, new reproductive mode, maternal care, captive breeding, rearing, larval development.

Given, M.F. (2005). **Vocalizations and reproductive behavior of male pickerel Frogs, *Rana palustris*.** *Journal of Herpetology* 39(2): 223-233. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: pickerel frogs, *Rana palustris*, reproductive behavior, vocalizations, male.

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.

Grace, M.S. (2003). **Timing of reproductive immigration in salamanders: roles of environmental cues and endogenous biological clocks.** *Herpetological Review* 91(1): 17-20. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: amphibians, salamander, reproductive immigration, endogenous biological clocks, environmental cues, role.

Green, S. (2002). **Factors affecting oogenesis in the South African clawed frog (*Xenopus laevis*).** *Comparative Medicine* 52(4): 307-312. ISSN: 1532-0820.
NAL Call Number: SF77.C65
Abstract: *Xenopus laevis*, commonly known as the South African Clawed frog, is a hardy adaptable species that is relatively easy to maintain as a laboratory animal. Gametogenesis in wild *Xenopus laevis* is continuous and under ideal conditions, reproduction can occur year round. This unique aspect of amphibian reproduction offers an advantage over mammalian model systems: the eggs and oocytes collected from laboratory maintained *Xenopus laevis* provide an abundant and readily obtainable supply of material for cellular and biological research. However, many investigators report that laboratory *Xenopus laevis* go through periods of unexplained inefficient or complete failure of oocyte production or the production of poor quality oocytes. This results in experimental delays, inability to reproduce data, and ultimately the use of more animals. There is a lack of evidenced based information regarding the housing conditions that are necessary to optimize the health and fecundity of this species in captivity, but studies of wild *Xenopus laevis* have shown that temperature, age of the female, and nutrition are of key importance. The objective of this report is to review oogenesis with a special emphasis on these factors as they pertain to laboratory *Xenopus laevis* maintained for the purpose of providing a steady supply of eggs and oocytes. Harvesting methods and other experimental techniques that affect the quality of eggs and oocytes are also discussed.
Descriptors: South African Clawed frog, *Xenopus laevis*, oogenesis, laboratory animals, ova,

oocytes, female fertility, temperature, age, diet, females, laboratory techniques, literature reviews, laboratory rearing, pituitary gonadal axis.

Hakansson, P. and J. Loman (2004). **Communal spawning in the common frog *rana temporaria* - egg temperature and predation consequences** . *Ethology* 110(9): 665-680. ISSN: 0179-1613.
NAL Call Number: QL750.E74
Descriptors: frog, *Rana temporaria*, communal spawning, egg temperature, pedation.

Halverson, M.A., D.K. Skelly, and A. Caccone (2006). **Inbreeding Linked to Amphibian Survival in the Wild but Not in the Laboratory.** *Journal of Heredity* 97(5): 499-507. ISSN: 0022-1503.
NAL Call Number: 442.8 Am3
Abstract: We examined the effects of inbreeding on the performance of wood frog (*Rana sylvatica*) larvae in the field and in the laboratory. We used microsatellite analysis to establish the parentage and degree of inbreeding of the larvae. Two different estimators of inbreeding were used. The first was based on average multilocus heterozygosity, and the second was based on a molecular relatedness estimator. The estimators were highly correlated, and both showed a significant negative relationship between inbreeding and survival in the wild. However, there was no evidence that inbreeding influenced growth or development in the wild. Neither was there any evidence that inbreeding affected survival, growth, or development in the laboratory. These results suggest that, for wood frogs, inbreeding has a bigger effect on fitness in the wild than in captivity and that measurements of survival are more sensitive than measures of growth or development.
Descriptors: amphibian, wood frog (*Rana sylvatica*), inbreeding, survival, larvae, field, laboratory, microsatellite analysis.

Harris, W.E. and J.R. Lucas (2002). **A state-based model of sperm allocation in a group-breeding salamander.** *Behavioral Ecology* 13(5): 705-712. ISSN: 1045-2249.
Descriptors: salamander, *Ambystoma texanum*, mathematical techniques, sperm, reproductive behavior, population density' intraspecific competition, sperm competition, optimal sperm allocation, state based model, Indiana, Tippecanoe county, USA.

Hartel, T. (2003). **The breeding biology of the frog *Rana dalmatina* in Tarnava Mare Valley, Romania.** *Russian Journal of Herpetology* 10(3): 169-174. ISSN: 1026-2296.
Descriptors: frog, *Rana dalmatina*, breeding biology, spawning period, eggs, Romania.

Hengl, T.J. and S. Burgin (2002). **Reproduction and larval growth of the urban dwelling brown striped marsh frog *limnodynastes peronii*.** *Australian Zoologist* 32(1): 62-68. ISSN: 0067-2238.
Descriptors: amphibians, striped marsh frog, *Limnodynastes peronii*, reproduction, larval growth, urban dwelling, egg viability, hatching success, Australia.

Hettyey, A. and P.B. Pearman (2003). **Social environment and reproductive interference affect reproductive success in the frog *Rana latastei.*** *Behavioral Ecology* 14(2): 294-300. ISSN: 1045-2249.
Descriptors: frog, *Rana*, reproductive behavior success , reproductive interference, social environment, affect.

Hobel, G. (2005). ***Rana clamitans* (Green Frog) and *Rana catesbeiana* (American Bullfrog). Reproduction.** *Herpetological Review* 36(4): 439-440. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: bullfrog, *Rana catesbeiana*, green frog , *Rana clamitans*, mating, reproduction.

Hobel, G. (2005). ***Rana palustris* (pickerel frog) and *Ambystoma maculatum* (spotted salamander). Reproductive behavior.** *Herpetological Review* 36(1): 55-56. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: pickerel frog , *Rana palustris*, spotted salamander, *Ambystoma maculatum*, reproductive behavior.

Huang He and Bai XiuJuan (2003). **Anatomical histological observation of reproductive organs of medicinal forest frog**. *Journal of Economic Animal* 7(2): 47-49. ISSN: 1007-7448.
Descriptors: amphibians, medicinal forest frog, reproductive organs, anatomy, ovaries, oviducts, testes, uterus, histological observation.
Language of Text: Chinese; Summary in English.

Iimori, E., M.J. D' Occhio, A.T. Lisle, and S.D. Johnston (2005). **Testosterone secretion and pharmacological spermatozoal recovery in the cane toad (*Bufo marinus*).** *Animal Reproduction Science* 90(1-2): 163-173. ISSN: 0378-4320.
NAL Call Number: QP251.A5
Descriptors: frogs, *Bufo marinus*, testosterone, hormone secretion, spermatozoa, animal models, toads, diurnal variation, gonadotropin releasing hormone, hormone agonists, intraperitoneal injection, human chorionic gonadotropin, follicle stimulating hormone, optimization, dosage, steroidogenesis, animal breeding.

Ishchenko, V.G. (2003). **The measurement of reproductive effort in amphibians.** *Russian Journal of Herpetology* 10(3): 207-212. ISSN: 1026-2296.
Descriptors: amphibians, reproductive effort, measurement, eggs, water.

Jofre, G.M., C.J. Reading, and I.E. di Tada (2005). **Breeding behaviour and reproduction in the Pampa de Achala toad, *Bufo achalensis*.** *Amphibia Reptilia* 26(4): 451-458. ISSN: 0173-5373.
Descriptors: toad, *Bufo achalensis*, reproduction, breeding behavior.

Keller, R. and D. Shook (2004). **Gastrulation in amphibians.** In: C.D. Stern (Editor), *Gastrulation: From Cells to Embryo.,* Cold Spring Harbor Laboratory Press: Cold Spring Harbor, NY, p. 171-203. ISBN: 0879697075.

NAL Call Number: QL955 .G34 2004
Descriptors: amphibians, embryo development, gastrulation, cells, literature review.

Kikuyama, S., T. Nakada, F. Toyoda, T. Iwata, K. Yamamoto, and J.M. Conlon (2005). **Amphibian pheromones and endocrine control of their secretion.** *Annals of the New York Academy of Sciences* 1040: 123-130. ISSN: 0077-8923.
NAL Call Number: 500 N484
Descriptors: amphibians, phermones, secretions, endocrine control, breeding.

Kunz, K. (2004). **Zum Paarungsverhalten Tropischer Krallenfroesche *Silurana* sp. Tiel 2. [The pairing behavior of the tropical clawed frogs *Silurana* sp. Part 2.]**. *Reptilia D* 9(1): 56-62 Nr 45. ISSN: 1431-8997.
Descriptors: tropical clawed frog, *Silurana* species, pairing behavior, mating, reproduction.
Language of Text: German.

Kupfer, A., J. Nabhitabhata, and W. Himstedt (2004). **Reproductive ecology of female caecilian amphibians (genus *Ichthyophis*): a baseline study.** *Biological Journal of the Linnean Society* 83(2): 207-217. ISSN: 0024-4066.
NAL Call Number: QH301.B56
Descriptors: caecilian amphibians, *Ichthyophis*, reproductive ecology, female, baseline study.

Lardner, B. and J. Loman (2003). **Growth or reproduction? Resource allocation by female frogs *Rana temporaria*.** *Oecologia Berlin* 137(4): 541-546. ISSN: 0029-8549.
Descriptors: frogs, female, *Rana temporaria*, resource allocation, growth, reproduction.

Lisboa, M.C., A.P.F. Melo, R.H.S. Ferraz, and R.F. Rodrigues (2003). **Topografia e irrigacao do oviduto de ra (*Rana catesbeiana*, shaw, 1802). [Oviduct topography and arterial vascularization of frog (*Rana catesbeiana*, shaw, 1802).]**. *Revista Brasileira De Reproducao Animal* 27(2): 292-294. ISSN: 0102-0803.
NAL Call Number: QP251.R48
Descriptors: amphibians, frog, cardiovascular, arterial vascularization, oviduct topography, anatomy.
Language of Text: Portuguese.

Lyapkov, S.M. (2005). **Geographical and local variation of reproductive and demographic characteristics in brown frogs.** *Russian Journal of Herpetology* 12: 187-190 (Suppl.) ISSN: 1026-2296.
Descriptors: brown frogs, reproductive characteristics, local variation, demographic, geographical.

Michael, S.F. and C. Jones (2004). **Cryopreservation of spermatozoa of the terrestrial Puerto Rican frog, *Eleutherodactylus coqui*.** *Cryobiology* 48(1): 90-94. ISSN: 0011-2240.
Abstract: World-wide reports of amphibian population declines have led to increased interest in the reproductive biology of anurans. As a model system, here we present evidence for the effective cryoprotection of sperm from the Puerto Rican frog, *Eleutherodactylus coqui*,

using mixtures of fetal bovine serum (FBS) and dimethylsulfoxide (Me(2)SO), glycerol or sucrose extenders. Using a fluorescent dye exclusion assay, we found that 53.9 and 50.4% of all sperm with intact membranes prior to freezing maintained membrane integrity after rapid freezing and thawing when protected with either a FBS/glycerol or FBS/sucrose solution, respectively. The methods reported here may be useful for similar work with many of the more than 700 other species in this genus.
Descriptors: frog, *Eleutherodactylus coqui*, spermataozoa, cryopreservation, reproductive biology, model system, fetal bovine serum, dimethylsulfoxide, glycerol, sucrose, extenders.

Mosconi, G., O. Carnevali, M.F. Franzoni, E. Cottone, I. Lutz, W. Kloas, K. Yamamoto, S. Kikuyama, and A.M. Polzonetti Magni (2002). **Environmental estrogens and reproductive biology in amphibians.** *General and Comparative Endocrinology* 126(2): 125-129. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: amphibians, *Xenopus laevis*, *Triturus carnifex*, sex determination, sexual differentiation, chemical factors, 4 nonyl phenol, sexual differentiation effects, overview.

Myers, E.M. and K.R. Zamudio (2003). **Genetic characterization of reproductive strategy in an amphibian with aggregate breeding.** *SICB Annual Meeting and Exhibition Final Program and Abstracts* 2003: 257-258. ISSN: print: 1540-7063; online: 1557-7023.
Descriptors: amphibians, reproductive strategy, genetic characterization, aggregate breeding, meeting.
Notes: Meeting Information: Annual Meeting and Exhibition of the SICB (Society for Integrative and Comparative Biology), Toronto, ON, Canada; January 4-8, 2003.

Nagao, Y., T. Nakazawa, and H. Ishikawa (2005). **Optimum atmospheric environment for the reproduction and the survival of the toad, *Bufo japonicus formosus* - II. Atmospheric conditions for the living activities of *Bufo japonicus formosus* other than the reproductive period in the center of Tokyo.** *Bulletin of the Biogeographical Society of Japan* 60: 57-68. ISSN: print: 0067-8716; online: 1880-8093.
Descriptors: toads, *Bufo japonicus formosus*, optimum atmospheric environment, reproduction, survival, Tokyo, Japan.
Language of Text: Japanese; Summary in English.

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.

Qian WeiPing (2004). **Study on artificial breeding technology of toad and growth law of clumped feeding**. *Journal of Economic Animal* 8(3): 157-160. ISSN: 1007-7448.
Descriptors: amphibians, toad, artificial breeding, technology, growth law, clumped feeding, study, rearing.
Language of Text: Chinese; Summary in English.

Qiao, Z.g., X.j. Li, X.y. Li, and C.s. Xu (2004). **Effects of temperature, light and preservative fluid on the survival of spermatozoa in Chinese giant salamander (*Andrias davidianus*).** *Fisheries Science Liaoning* 23(3): 10-12. ISSN: 1003-1111.
Descriptors: Chinese giant salamander, *Andrias davidianus*, effects, temeperature, light, preservative fluid, survival of spermatazoa.
Language of Text: Chinese; Summary in Chinese and English.

Qin, L.M., F. Xie, Z.H. Zheng, and J.P. Jiang (2005). **Sperm morphology of alpine stream salamander, *Batrachuperus tibetanus*.** *Chinese Journal of Zoology* 40(2): 71-74. ISSN: 0250-3263.
Descriptors: *Batrachuperus tibetanus*, sperm, morphology, alpine stream salamander.
Language of Text: Chinese; Summary in Chinese and English.

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.

Ramos, I., S. Cisint, C.A. Crespo, M.F. Medina, and S.N. Fernandez (2002). **Involvement of catecholamines in the regulation of oocyte maturation in frogs.** *Zygote* 10(3): 271-281. ISSN: 0967-1994.
Descriptors: amphibians, *Bufo arenarum*, hormones, catecholamines, oogenesis, oocyte maturation, role of catecholamines.

Rastogi, R.K., L. Iela, M. di Meglio, M.M. Di Fiore, B. D'Aniello, C. Pinelli, and M. Fiorentino (2005). **Hormonal regulation of reproductive cycles in amphibians.** *Amphibian Biology* 6: 2045-2177.
Descriptors: amphibians, hormonal regulation, reproductive cycles, review, reproductive cycles.

Raucci, F. and M.M. Di Fiore (2007). **The c-kit receptor protein in the testis of green frog *Rana esculenta*: Seasonal changes in relationship to testosterone titres and spermatogonial proliferation.** *Reproduction* 133(1): 51-60. ISSN: 1470-1626.

Abstract: The green frog *Rana esculenta* is a seasonal breeder. The cyclic changes between almost arrested and highly activated spermatogenesis offer an ideal model to study basic mechanisms of spermatogenesis. In this study, we demonstrated, to our knowledge for the first time, c-kit receptor positive cells in the testis of this amphibian. The presence of c-kit receptor protein was confirmed by western blotting (Wb) analyses carried out in the testis during all the three main phases of the sexual cycle. The antibody recognized a band of about 150 kDa that was correlated with the positive staining in the germinal epithelium. The immunolabelling for c-kit receptor, evaluated by immunohistochemistry (IHC), was localized in I and II spermatogonia (SPG), in I and II spermatocytes, in both elongating spermatids and spermatozoa and in the Leydig cells. Furthermore, c-kit expression showed a seasonal pattern connected with both testicular and plasma profiles of testosterone during the reproductive cycle. The highest expression of c-kit receptor occurred during the reproductive period, when the testis exhibited the maximum concentration of testosterone. In this period, the mitotic activity of germ cell, assessed by both Wb and IHC analyses for proliferating cell nuclear antigen (PCNA), was intensive. Indeed, during the post-reproductive period, testosterone titres were the lowest and the expression of both PCNA and c-kit receptor protein in the testis, although present, is minor when compared with the reproductive phase. This evidence suggests that cell division can continue sufficiently to accumulate SPG for the next spring, when new germinal cells undergo multiplication. Finally, during the pre-reproductive period, testosterone levels begin to increase and mitotic activity of germinal epithelium is comparably enhanced. These events seem to precede the period of maximum stimulated spermatogonial proliferation, i.e. the reproductive period. These results suggest that the c-kit receptor may play a role in germ cell proliferation and provide a basis for future detailed investigation of regulatory factors of the proliferation of SPG.

Descriptors: green frog, *Rana esculenta*, seasonal breeder, spermatogenesis, germ cell, amphibian, reproductive cycle, mitotic activity.

Reading, C.J. (2003). **The effects of variation in climatic temperature (1980-2001) on breeding activity and tadpole stage duration in the common toad, *Bufo bufo*.** *Science of the Total Environment* 310(1-3): 231-236. ISSN: 0048-9697.

Descriptors: amphibians, toad, *Bufo bufo*, breeding activity, climatic temperature, variation, effects, tadpole stage duration.

Reyer, H.U. and I. Battig (2004). **Identification of reproductive status in female frogs - a quantitative comparison of nine methods.** *Herpetologica* 60(3): 349-357. ISSN: 0018-0831.

NAL Call Number: QL640.H4

Descriptors: female frogs, reproductive status, identification, quantitative comparison, nine methods.

Roedel, M.O., K.P. Lampert, and K.E. Linsenmair (2006). **Reproductive biology of the West African savannah frog *Hyperolius nasutus* Guenther, 1864 (Amphibia: Anura: Hyperoliidae).** *Herpetozoa* 19(1-2): 3-12. ISSN: 1013-4425.
Descriptors: savannah frog, *Hyperolius nasutus*, reproductive biology, mating activities.
Language of Text: English; German.

Ruthig, G.R. (2003). **The influence of infectious disease on amphibian egg-laying behavior.** *Ecological Society of America Annual Meeting Abstracts* 88: 293. ISSN: 0012-9623.
Descriptors: amphibians, egg laying behavior, infectious disease, influence, meeting.
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.

Saxena, S., K. Singhal, and Suman (2003). **Effect of testosterone on the sex-differentiation in toad *Bufo andersonii*.** *Journal of Advanced Zoology* 24(1-2): 21-26. ISSN: 0253-7214.
Descriptors: toad, *Bufo andersonii*, testosterone, effect, sex determination, sex differentiation, effects of testosterone.

Sequeira, F., N. Ferrand, and E.G. Crespo (2003). **Reproductive cycle of the golden-striped salamander *Chioglossa lusitanica* (Caudata, Salamandridae) in nw Portugal.** *Amphibia Reptilia* 24(1): 1-12. ISSN: 0173-5373.
Descriptors: amphibians, salamander, *Chioglossa lusitanica*, reproductive cycle, Portugal.

Servoss, J.M. and K.M. Sharrocks (2006). ***Rana chiricahuensis* (Chiricahua leopard frog) and *Rana catesbeiana* (American bullfrog). Reproductive behavior.** *Herpetological Review* 37(2): 208. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: *Rana catesbeiana*, bullfrog, *Rana chiricahuensis*, leopard frog, reproductive behavior, mating.

Sever, D.M. (2002). **Female sperm storage in amphibians.** *Journal of Experimental Zoology* 292(2): 165-179. ISSN: print: 0022-104X; online: 1097-010X.
NAL Call Number: 410 J825
Descriptors: amphibians, fertilization, sperm storage, mechanisms, reproductive system, sperm storage sites, mechanisms, comparative study.

Shalan, A.G., S.D. Bradshaw, P.C. Withers, G. Thompson, M.F.F. Bayomy, F.J. Bradshaw, and T. Stewart (2004). **Spermatogenesis and plasma testosterone levels in Western Australian burrowing desert frogs, *Cyclorana platycephala*, *Cyclorana maini*, and *Neobatrachus sutor*, during aestivation.** *General and Comparative Endocrinology* 136(1): 90-100. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: amphibians, western burrowing frogs, *Cyclorana maini*, *Cyclorana platycephala*, *Neobatrachus sutor*, spermatogenesis and plasma testosterone levels in burrowing desert frogs, during estivation.

Smith, M.J., P.C. Withers, and J.D. Roberts (2003). **Reproductive energetics and behavior of an Australian myobatrachid frog *Crinia georgiana*.** *Copeia* 2003(2): 248-254. ISSN: 0045-8511.

Descriptors: frog, *Crinia georgiana*, amphibians, reproductive energetics, behavior, myobatrachid frog, male.

Som, C. and H.U. Reyer (2007). **Hemiclonal reproduction slows down the speed of Muller's ratchet in the hybridogenetic frog *Rana esculenta*.** *Journal of Evolutionary Biology* 20(2): 650-660. ISSN: 1010-061X.

Abstract: Rare recombination in otherwise asexually reproducing organisms is known to beneficially influence the fitness in small populations. In most of the investigated organisms, asexual and rare sexual generations with recombination follow each other sequentially. Here we present a case where clonal reproduction and rare recombination occur simultaneously in the same population. The hybridogenetic water frog *Rana esculenta* (E), a hybrid between *R. lessonae* (L) and *R. ridibunda* (R) produces gametes that only contain the unaltered maternal R part of their genome. New generations of *R. esculenta* usually arise from E x L matings. Intraspecific E x E matings produce mostly inviable offspring, but in rare cases, female *R. ridibunda* arise from such matings which are capable of recombination. In the absence of conspecific males, these R females have to mate with E males, which results in further R females, or with L males, which produces new E lineages. This indirect mechanism reintroduces recombination into the otherwise clonally transmitted R genomes in *R. esculenta* populations. In this study, we show through Monte Carlo simulations that, in most cases, it is sufficient that only between 1 % and 10 % of mixed water frog populations consist of R females to prevent or significantly reduce the fixation and accumulation of deleterious mutations.

Descriptors: frog, *Rana esculenta*, cyclical parthenogenesis, hybridogenesis, mutation accumulation, *Rana lessonae*, recombination.

Soud, R. and R. Das (2006). **Observation on the courtship of bamboo tree frog *Polypedates leucomystax* (Gravenhorst) (Anura: Rhacophoridae).** *Cobra Chennai* 63: 16-18.

Descriptors: *Polypedates leucomystax*, bamboo tree frog, courtship observations, reproduction, mating.

Stephenson, B. and P. Verrell (2003). **Courtship and mating of the tailed frog (*Ascaphus truei*).** *Journal of Zoology* 259(1): 15-22. ISSN: 0952-8369.

Descriptors: amphibians, tailed frog, *Ascaphus truei*, courtship, mating, anura.

Stevens, K. and M. Nelson (2006). **The captive reproduction of Amazon milk frogs (*Phrynohyas resinifictrix*).** *Herptile* 31(3): 79-82. ISSN: 0953-2021.

Descriptors: Amazon milk frogs, *Phrynohyas resinifictrix*, captive care, reproduction, breeding methods.

Sun, Z.G., W.H. Kong, Y.J. Zhang, S. Yan, J.N. Lu, Z. Gu, F. Lin, and J.K. Tso (2002). **A novel ubiquitin carboxyl terminal hydrolase is involved in toad oocyte maturation**. *Cell Research* 12(3-4): 199-206. ISSN: print: 1001-0602; online: 1748-7838.
Descriptors: amphibians, toad, *Bufo bufo*, novel ubiquitin carboxyl terminal hydrolase, oocyte maturation, progesterone induced.

Sundell, J.J. and B.R. Norman (2002). ***Ensatina eschscholtzii* oregonensisxpicta [*Oregonxpainted salamander intergrade]*. Reproduction/brooding behavior.** *Herpetological Review* 33(4): 297-298. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: amphibians, salamander, reproduction, brooding behavior.

Tsai, P.S., J.B. Lunden, and J.T. Jones (2003). **Effects of steroid hormones on spermatogenesis and GnRH release in male Leopard frogs, *Rana pipiens*.** *General and Comparative Endocrinology* 134(3): 330-338. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: leopard frogs, male, *Rana pipiens*, steroid hormones, effects, spermatogenesis and gnRH release.

Tsuji, H. (2004). **Reproductive ecology and mating success of male *limnonectes kuhlii*, a fanged frog from Taiwan**. *Herpetologica* 60(2): 155-167. ISSN: 0018-0831.
NAL Call Number: QL640.H4
Descriptors: amphibians, fanged frog, *limnonectes kuhlii*, reproductive ecology, male mating success, body size, polygyny mating system, Taiwan.

Tyagi, R.S.A.N. (2002). ***Encyclopaedia of Amphibia. Volume 3. Amphibian Sex Organs.***, Anmol: New Delhi, 303 p. ISBN: 8126110236.
Descriptors: amphibians, encyclopedia, amphibian sex organs, reproductive system, sex organs.

Vaira, M. (2005). **Annual variation of breeding patterns of the toad, *Melanophryniscus rubriventris* (Vellard, 1947).** *Amphibia Reptilia* 26(2): 193-199. ISSN: 0173-5373.
Descriptors: toad, *Melanophryniscus rubriventris*, breeding patterns, annual variation.

Verrell, P.A. (2004). **The male reproductive cycle of the North American salamander *Ambystoma macrodactylum columbianum*.** *Amphibia Reptilia* 25(3): 349-356. ISSN: 0173-5373.
Descriptors: amphibians, *Ambystoma macrodactylum columbianum*, male reproductive cycle, North American salamander.

Verrell, P.a. (2006). **The female reproductive cycle of the north american salamander *ambystoma macrodactylum columbianum***. *Amphibia Reptilia* 27(2): 274-277. ISSN: 0173-5373.
Descriptors: amphibians, salamander, *Ambystoma macrodactylum columbianum.*, female, reproductive cycle.

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.

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.

Xie Feng, Fei Liang, Ye Chang Yuan, Wang Zu Wang, and Cai Chun Mo (2002). **Oviposition sites and their effects on the reproductive success in the Chinhai salamander (*Echinotriton chinhaiensis*).** *Acta Zoologica Sinica* 48(4): 554-557. ISSN: 0001-7302.
NAL Call Number: 410 AC87
Descriptors: amphibians, salamander, *Echinotriton chinhaiensis*, Chinhai salamanders, oviposition sites, effect, reproductive success.
Language of Text: Chinese.

Yurewicz, K.L. and H.M. Wilbur (2004). **Resource availability and costs of reproduction in the salamander *Plethodon cinereus*.** *Copeia* 2004(1): 28-36. ISSN: 0045-8511.
Descriptors: salamander, *Plethodon cinereus*, costs of reproduction, resource avaialability.

Zheng, R.Q., W.G. Du, and L. Shou (2002). **Sexual dimorphism and female reproductive characteristics in the black-spotted pond frog, *Pelophylax nigromaculata*.** *Chinese Journal of Zoology* 37(4): 14-18. ISSN: 0250-3263.
Descriptors: amphibians, frog, *Pelophylax nigromaculata*, biometrics, morphological sex differences, morphometrics, egg number, clutch size, female size relationships, Zhejiang, Jinhua, sexual dimorphism, clutch size.
Language of Text: Chinese; Summary in Chinese and English.

Research

Aggeli, I.K.S., C. Gaitanaki, A. Lazou, and I. Beis (2002). **Hyperosmotic and thermal stresses activate p38-MAPK in the perfused amphibian heart.** *Journal of Experimental Biology* 205(4): 443-454. ISSN: 0022-0949.
NAL Call Number: 442.8 B77
Descriptors: amphibians, *Rana ridibunda*, enzymes, p38 mapk activation, effects of thermal and osmotic stresses in perfused heart, functional implications, heart, salinity, temperature.

Ahmad, M., M. Ahmad, R. Hasan, and A. Qureshi (2005). **The effects of isoniazid (INH) on the hematocrit of the lizard, *Uromastix hardwickii*.** *Pakistan Journal of Pharmaceutical Sciences* 18(1): 52-54. ISSN: 1011-601X.
Abstract: In recent years isoniazid has been used as an antituberculous chemophylactic agent. Severe adverse reactions have been reported following its extensive treatment. In addition to hepatic and neurologic disturbances, hematologic alterations have also been reported. Present study was conducted to determine the effect of 0.06 mg isoniazid on the lacertilian packed cell volume. It was 14.0 per cent on day 5, 18.0 and 19.8 per cent on day 10 and day 15 respectively, whereas, it was 24.0, 24.2 and 24.6 per cent in controls on day 5, 10 and day 15 respectively.
Descriptors: lizard, antitubercular agents adverse effects, erythrocytes drug effects, iguanas blood, isoniazid adverse effects, administration, oral, erythrocytes cytology, hematocrit.

Ahmad, M., R. Hasan, M. Ahmad, A. Qureshi, Z. Ahmed, and S. Mansoor (2005). **The effects of mefenamic acid on the blood haemoglobin of the lizard, *Uromastix hardwickii*.** *Pakistan Journal of Pharmaceutical Sciences* 18(4): 41-45. ISSN: 1011-601X.
Abstract: This study deals with the effect of 7.1 mg/day, 10.5 mg/day and 14 mg/day doses of mefenamic acid administered for 12 days to three groups of *Uromastix hardwickii* respectively. Individual blood samples were obtained from the anterior abdominal vein and hemoglobin content was determined. The hemoglobin in test was 5.1 g/100 ml compared to 8.0 g/100 ml of controls in experiment I and its amount remained almost similar in the case of experiment II, whereas, 4.5 g/100 ml was observed of test compared to 8.0 g/100 ml of their counterparts.
Descriptors: anti-inflammatory agents, non steroidal pharmacology, hemoglobins metabolism, lizards, mefenamic acid, methemoglobin, reference standards.

Alberio, S.O., J.A. Diniz, E.O. Silva, W. de Souza, and R.A. DaMatta (2005). **Cytochemical and functional characterization of blood and inflammatory cells from the lizard *Ameiva ameiva*.** *Tissue and Cell* 37(3): 193-202. ISSN: 0040-8166.
NAL Call Number: QH573.T5
Abstract: The fine structure and differential cell count of blood and coelomic exudate leukocytes were studied with the aim to identify granulocytes from *Ameiva ameiva*, a lizard distributed in the tropical regions of the Americas. Blood leukocytes were separated with

a Percoll cushion and coelomic exudate cells were obtained 24 h after intracoelomic thioglycollate injection. In the blood, erythrocytes, monocytes, thrombocytes, lymphocytes, plasma cells and four types of granulocytes were identified based on their morphology and cytochemistry. Types I and III granulocytes had round intracytoplasmic granules with the same basic morphology; however, type III granulocyte had a bilobued nucleus and higher amounts of heterochromatin suggesting an advance stage of maturation. Type II granulocytes had fusiformic granules and more mitochondria. Type IV granulocytes were classified as the basophil mammalian counterpart based on their morphology and relative number. Macrophages and granulocytes type III were found in the normal coelomic cavity. However, after the thioglycollate injection the number of type III granulocyte increased. Granulocytes found in the coelomic cavity were related to type III blood granulocyte based on the morphology and cytochemical localization of alkaline phosphatase and basic proteins in their intracytoplasmic granules. Differential blood leukocyte counts showed a predominance of type III granulocyte followed by lymphocyte, type I granulocyte, type II granulocyte, monocyte and type IV granulocyte. Taken together, these results indicate that types I and III granulocytes correspond to the mammalian neutrophils/heterophils and type II to the eosinophil granulocytes.
Descriptors: lizard blood, blood platelets ultrastructure, erythrocytes ultrastructure, granulocytes ultrastructure, lizard anatomy, histology, lymphocytes ultrastructure, electron microscopy, transmission, monocytes ultrastructure.

Arikan, H., M.K. Atatur, and M. Tosunoglu (2003). **A study on the blood cells of the Caucasus Frog, *Pelodytes caucasicus*.** *Zoology in the Middle East* 30: 43-47. ISSN: 0939-7140.
Descriptors: amphibian, *Pelodytes caucasicus*, size, blood cells, study, characterization, Caucasus frog.
Language of Text: English; German.

Azevedo, R.A., A.S. de Jesus Santana, and L. de Brito Gitirana (2006). **Dermal collagen organization in *Bufo ictericus* and in *Rana catesbeiana* integument (Anuran, Amphibian) under the evaluation of laser confocal microscopy.** *Micron* 37(3): 223-228. ISSN: 0968-4328.
Descriptors: amphibians, *Bufo ictericus*, *Rana catesbeiana*, dermal collagen organization, evaluation, laser confocal microscopy.

Banerjee, S.N. and S. Chakrabarti (2003). **Chromosomal sex determination in anuran amphibians.** *Hamadryad* 27(2): 248-253. ISSN: 0972-205X.
Descriptors: Anura, amphibians, genetics, chromosomal sex determination, overview.

Bardeleben, C., M.M. Gray, and C.J. Hoskin (2006). **Isolation of polymorphic tetranucleotide microsatellite markers for the ornate nursery frog *Cophixalus ornatus*.** *Molecular Ecology Notes* 6(3): 888-890. ISSN: 1471-8278.
Abstract: We have isolated 18 polymorphic microsatellite loci for *Cophixalus ornatus* from genomic libraries enriched for (AAAG)n, (AACC)n and (AAGG)n repetitive elements. The number of alleles ranges from five to 22 per locus with the observed heterozygosity ranging from 0.10 to 0.92. These markers will be useful for the analysis of population structure in *C.*

ornatus and testing alternative models of speciation.
Descriptors: frog, microsatellite markers, isolation, genomic libraries, models of speciation.

Barnes, W.J.P., C. Oines, and J.M. Smith (2006). **Whole animal measurements of shear and adhesive forces in adult tree frogs: insights into underlying mechanisms of adhesion obtained from studying the effects of size and scale.** *Journal of Comparative Physiology A Sensory Neural and Behavioral Physiology* 192(11): 1179-1191. ISSN: 0340-7594.
NAL Call Number: QP33.J68
Abstract: This allometric study of adhesion in 15 Trinidadian tree frog species investigates how relationships between length, area and mass limit the ability of adult frog species of different sizes to adhere to inclined and overhanging surfaces. Our experiments show that hylid frogs possess an area-based wet adhesive system in which larger species are lighter than expected from isometry and adhere better than expected from their toe pad area. However, in spite of these adaptations, larger species adhere less well than smaller species. In addition to these adhesive forces, tree frogs also generate significant shear forces that scale with mass, suggesting that they are frictional forces. Toe pads detach by peeling and frogs have strategies to prevent peeling from taking place while they are adhering to surfaces, including orienting themselves head-up on slopes. The scaling of tree frog adhesion is also used to distinguish between different models for adhesion, including classic formulae for capillarity and Stefan adhesion. These classic equations grossly overestimate the adhesive forces that tree frogs produce. More promising are peeling models, designed to predict the pull-off forces of adhesive tape. However, more work is required before we can qualitatively and quantitatively describe the adhesive mechanism of tree frogs.
Descriptors: tree frogs, adhesive forces, length, mass limit, adherance, wet adhesive system, adhesive mechanism.

Bartelt, P.E. and C.R. Peterson (2005). **Physically modeling operative temperatures and evaporation rates in amphibians.** *Journal of Thermal Biology* 30(2): 93-102. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: amphibians, *Bufo boreas*, physiological techniques, evaporation rate, physical model, temperature, thermal properties.

Basaglia, F. (2004). **Comparative study of electrophoretic and isoelectrophoretic characteristics of osteichthyan and amphibian hemoglobin.** *Italian Journal of Zoology* 71(4): 287-295. ISSN: 1125-0003.
NAL Call Number: QL1.B55
Descriptors: amphibians, osteichthyes, hemoglobin, electrophoretic and isoelectrophoretic characteristics, comparative study.

Beebee, T.J.C. (2005). **Conservation genetics of amphibians.** *Heredity* 95(6): 423-427. ISSN: 0018-067X.
Descriptors: amphibians, genetics research, conservation genetics.

Belzile, O., E. Simard, R. Gulemetova, A. Bairam, and R. Kinkead (2004). **Un modele amphibien pour l'etude du developpement du controle de la respiration. [Amphibians as a model system for the investigation of respiratory control development]**. *Medecine Sciences MS* 20(10): 904-908. ISSN: 0767-0974.

Abstract: Recent medical advances have made it possible for babies to survive premature birth at increasingly earlier developmental stages. This population requires costly and sophisticated medical care to address the problems associated with immaturity of the respiratory system. In addition to pulmonary complications, respiratory instability and apnea reflecting immaturity of the respiratory control system are major causes of hospitalization and morbidity in this highly vulnerable population. These medical concerns, combined with the curiosity of physiologists, have contributed to the expansion of research in respiratory neurobiology. While most researchers working in this field commonly use rodents as an animal model, recent research using in vitro brainstem preparation from bullfrogs (*Rana catesbeiana*) have revealed the technical advantages of this animal model, and shown that the basic principles underlying respiratory control and its ontogeny are very similar between these two groups of vertebrates. The present review highlights the recent advances in the area of research with a focus on intermittent (episodic) breathing and the role of serotonergic and GABAergic modulation of respiratory activity during development.

Descriptors: amphibians, bull frogs, animal model system, respiratory control system, episodicbreathing investigation, premature birth of human babies, immaturity, rodents.

Language of Text: French.

Bernareggi, A., Z. Duenas, J.M. Reyes Ruiz, F. Ruzzier, and R. Miledi (2007). **Properties of glutamate receptors of Alzheimer's disease brain transplanted to frog oocytes.** *Proceedings of the National Academy of Sciences of the United States of America.* 104(8): 2956-2960. ISSN: 0027-8424.

NAL Call Number: 500 N21P

Abstract: It is known that Alzheimer's disease (AD) is a synaptic disease that involves various neurotransmitter systems, particularly those where synaptic transmission is mediated by acetylcholine or glutamate (Glu). Nevertheless, very little is known about the properties of neurotransmitter receptors of the AD human brain. We have shown previously that cell membranes, carrying neurotransmitter receptors from the human postmortem brain, can be transplanted to frog oocytes, and their receptors will still be functional. Taking advantage of this fact, we have now studied the properties of Glu receptors (GluRs) from the cerebral cortices of AD and non-AD brains and found that oocytes injected with AD membranes acquired GluRs that have essentially the same functional properties as those of oocytes injected with membranes from non-AD brains. However, the amplitudes of the currents elicited by Glu were always smaller in the oocytes injected with membranes from AD brains. Western blot analyses of the same membrane preparations used for the electrophysiological studies showed that AD membranes contained significantly fewer GluR2/3 subunit proteins. Furthermore, the corresponding mRNAs were also diminished in the AD brain. Therefore, the smaller amplitude of membrane currents elicited by Glu in oocytes injected with membranes from an AD brain is a consequence of a reduced number of GluRs in cell membranes transplanted from the AD brain. Thus, using the comparatively simple method

of microtransplantation of receptors, it is now possible to determine the properties of neurotransmitter receptors of normal and diseased human brains. That knowledge may help to decipher the etiology of the diseases and also to develop new treatments.
Descriptors: frogs, animal model for Alzheimer's disease, oocytes, glutamate receptors, disease brain, transplanted, neurotransmitter system.

Birinyi, A., G. Szekely, K. Csapo, and C. Matesz (2004). **Quantitative morphological analysis of the motoneurons innervating muscles involved in tongue movements of the frog *Rana esculenta*.** *Journal of Comparative Neurology* 470(4): 409-421. ISSN: 0021-9967.
Descriptors: amphibians, frog, tongue movements, innervating muscles, morphological analysis, protractor, retractor, inner, prey catching.

Brinkworth, C.S., J.H. Bowie, M.J. Tyler, and J.C. Wallace (2002). **A comparison of the antimicrobial skin peptides of the New Guinea tree frog (*Litoria genimaculata*) and the fringed tree frog (*Litoria eucnemis*).** *Australian Journal of Chemistry* 55(9): 605-610. ISSN: 0004-9425.
Descriptors: New guinea tree frog, *Litoria eucnemis*, fringed tree frog , *Litoria genimaculata*, comparison, antimicrobial skin peptides.

Broquet, T., L. Berset Braendli, G. Emaresi, and L. Fumagalli (2007). **Buccal swabs allow efficient and reliable microsatellite genotyping in amphibians**. *Conservation Genetics* 8(2): 509-511. ISSN: 1566-0621.
Descriptors: amphibians, buccal swabs , microsatellite genotyping, efficient, reliable.

Buchanan, B.W. (2006). **Observed and potential effects of artificial night lighting on anuran amphibians.** In: C. Rich and T. Longcore (Editors), *Ecological Consequences of Artificial Night Lighting.,* Island Press: Washington, DC, p. 192-200. ISBN: 1559631287.
NAL Call Number: QH545.E98 E26 2006
Descriptors: amphibians, anurans, exterior lighting, environmental aspects, artificial night lighting, observed and potential effects.

Buchholz, D.R., B.D. Paul, and Y.B. Shi (2005). **Gene-specific changes in promoter occupancy by thyroid hormone receptor during frog metamorphosis: Implications for developmental gene regulation.** *Journal of Biological Chemistry* 280(50): 41222-41228. ISSN: 0021-9258.
Online: http://dx.doi.org/10.1074/jbc.M509593200
NAL Call Number: 381 J824
Abstract: In all vertebrates, thyroid hormones (TH) affect postembryonic development. The role of the TH receptor (TR) in mediating the TH signal is complex as evidenced by divergent phenotypes in mice lacking TH compared with TR knock-out mice. We have proposed a dual function model for TR during development based on studies of frog metamorphosis. Here we examined an important assumption of this dual function model by using the chromatin immunoprecipitation assay, namely constitutive TR binding to promoters in vivo. We examined two target genes with TH-response elements (TRE) in their promoters, TR[beta] itself and TH/bZIP (TH-responsive basic leucine zipper transcription factor). By using an

antibody that recognizes both TR[alpha] and TR[beta], we found that TR binding to the TR[beta] promoter is indeed constitutive. Most surprisingly, TR binding to the TH/bZIP promoter increases dramatically after TH treatment of premetamorphic tadpoles and during metamorphosis. By using an antibody specific to TR[beta],TR[beta] binding increases at both promoters in response to TH. In vitro biochemical studies showed that TRs bind TH/bZIP TRE with 4-fold lower affinity than to TR[beta] TRE. Our data show that only high affinity TR[beta] TRE is occupied by limiting levels of TR during premetamorphosis and that lower affinity TH/bZIP TRE becomes occupied only when overall the TR expression is higher during metamorphosis. These data provide the first in vivo evidence to suggest that one mechanism for tissue- and gene-specific regulation of TR target gene expression is through tissue and developmental stage-dependent regulation of TR levels, likely a critical mechanism for coordinating development in different organs during postembryonic development.
Descriptors: frog, postembryotic development, gene specific changes, thyroid hormones, metamorphosis, gene regulation.

Burlibasa, L., N. Cucu, and L. Gavrila (2005). **Amphibians as model organisms for studying the dynamics of eukaryote genetic material architecture.** *Wildlife Biology in Practice* 1(1): 24-32. ISSN: print: 1646-1509; online: 1646-2742.
Online: http://dx.doi.org/10.2461/wbp.2005.1.4
Descriptors: amphibia, animal model, study of dynamics of eukaryote genetic architecture, review, cytogenetics.

Calzolai, L., D.A. Lysek, D.R. Perez, P. Guntert, and K. Wuthrich (2005). **Prion protein NMR structures of chickens, turtles, and frogs.** *Proceedings of the National Academy of Sciences of the United States of America* 102(3): 651-655. ISSN: print: 0027-8424; online: 1091-6490.
NAL Call Number: 500 N21P
Abstract: The NMR structures of the recombinant prion proteins from chicken (*Gallus gallus*; chPrP), the red-eared slider turtle (*Trachemys scripta*; tPrP), and the African clawed frog (*Xenopus laevis*; xlPrP) are presented. The amino acid sequences of these prion proteins show approximately 30% identity with mammalian prion proteins. All three species form the same molecular architecture as mammalian PrP(C), with a long, flexibly disordered tail attached to the N-terminal end of a globular domain. The globular domain in chPrP and tPrP contains three alpha-helices, one short 3(10)-helix, and a short antiparallel beta-sheet. In xlPrP, the globular domain includes three alpha-helices and a somewhat longer beta-sheet than in the other species. The spatial arrangement of these regular secondary structures coincides closely with that of the globular domain in mammalian prion proteins. Based on the low sequence identity to mammalian PrPs, comparison of chPrP, tPrP, and xlPrP with mammalian PrP(C) structures is used to identify a set of essential amino acid positions for the preservation of the same PrP(C) fold in birds, reptiles, amphibians, and mammals. There are additional conserved residues without apparent structural roles, which are of interest for the ongoing search for physiological functions of PrP(C) in healthy organisms.
Descriptors: prions, nuclear magnetic resonance spectroscopy, chickens, *Trachemys scripta*, turtles, *Xenopus laevis*, frogs, amino acid sequences, protein secondary structure.

Carr, J.A. and P.E. Zozzaro (2004). **The toad iris assay: a simple method for evaluating CRH action on the sympathetic nervous system.** *General and Comparative Endocrinology* 135(1): 134-141. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: toad, *Bufo speciosus*, iris assay, evaluating CRH action, sympathetic nervous system, simple method, evaluating.

Carrasquer, G. and M. Li (2002). **Effect of ibuprofen and rofecoxib transport parameters in the frog corneal epithelium.** *Journal of Membrane Biology* 190(2): 127-132. ISSN: 0022-2631.
NAL Call Number: QH573.J6
Descriptors: amphibians, frog, ibuprofen, effect, corneal epithelium, rofecoxib transport parameters, cox inhibitors.

Carrasquer, G., M. Li, and M. Schartz (2002). **Effect of ibuprofen (ibu) on ion transport in the frog gastric epithelium**. *Journal of the American Society of Nephrology* 13(Program and Abstracts Issue): 671A. ISSN: 1046-6673.
Descriptors: frog, gastric epithelium, ibuprofen effect, ion transport, meeting.
Notes: Meeting Information: Meeting of the American Society of Nephrology, Philadelphia, PA, USA; October 30-November 4, 2002.

Carrasquer, G., M. Li, and M. Schwartz (2003). **Effect of ibuprofen on transport parameters in the resting frog gastric mucosa.** *FASEB Journal* 17(4-5): Abstract No. 330.15. ISSN: 0892-6638.
NAL Call Number: QH301.F3
Descriptors: ibuprofen, transport parameters, resting frog gastric mucosa, effect, meeting.
Notes: Meeting Information: FASEB Meeting on Experimental Biology: Translating the Genome, San Diego, CA, USA; April 11-15, 2003.

Chang, C., A.H. Brivanlou, and R.M. Harland (2006). **Function of the two *Xenopus* Smad4s in early frog development.** *Journal of Biological Chemistry* 281(41): 30794-30803. ISSN: 0021-9258.
Online: http://dx.doi.org/10.1074/jbc.M607054200
NAL Call Number: 381 J824
Abstract: Signals from the transforming growth factor (Sb(B family members are transmitted in the cell through specific receptor-activated Smads and a common partner Smad4. Two Smad4 genes ((Sa(B and (Sb(B/10, or smad4 and smad4.2) have been isolated from Xenopus, and conflicting data are reported for Smad4(Sb(B/10 actions in mesodermal and neural induction. To further understand the functions of the Smad4s in early frog development, we analyzed their activities in detail. We report that Smad10 is a mutant form of Smad4(Sb(B that harbors a missense mutation of a conserved arginine to histidine in the MH1 domain. The mutation results in enhanced association of Smad10 with the nuclear transcription corepressor Ski and leads to its neural inducing activity through inhibition of bone morphogenetic protein (BMP) signaling. In contrast to Smad10, both Smad4(Sa(B and Smad4(Sb(B enhanced BMP signals in ectodermal explants. Using antisense morpholino

oligonucleotides (MOs) to knockdown endogenous Smad4 protein levels, we discovered that Smad4(Sb(B was required for both activin- and BMP-mediated mesodermal induction in animal caps, whereas Smad4(Sa(B affected only the BMP signals. Neither Smad4 was involved directly in neural induction. Expression of Smad4(Sb(B-MO in early frog embryos resulted in reduction of mesodermal markers and defects in axial structures, which were rescued by either Smad4(Sa(B or Smad4(Sb(B. Smad4(Sa(B-MO induced only minor deficiency at late stages. As Smad4(Sb(B, but not Smad4(Sa(B, is expressed at high levels maternally and during early gastrulation, our data suggest that although Smad4(Sa(B and Smad4(Sb(B may have similar activities, they are differentially utilized during frog embryogenesis, with only Smad4(Sb(B being essential for mesoderm induction.
Descriptors: *Xenopus*, early frog development, growth factor, Smad4 genes, embryos.

Chemeris, N.K., A.B. Gapeyev, N.P. Sirota, O.Y. Gudkova, N.V. Kornienko, A.V. Tankanag, I.V. Konovalov, M.E. Buzoverya, V.G. Suvorov, and V.A. Logunov (2004). **DNA damage in frog erythrocytes after in vitro exposure to a high peak-power pulsed electromagnetic field.** *Mutation Research* 558(1-2): 27-34. ISSN: 0027-5107.
NAL Call Number: QH431.M8
Abstract: Till the present time, the genotoxic effects of high peak-power pulsed electromagnetic fields (HPPP EMF) on cultured cells have not been studied. We investigated possible genotoxic effects of HPPP EMF (8.8 GHz, 180 ns pulse width, peak power 65 kW, repetition rate 50 Hz) on erythrocytes of the frog *Xenopus laevis*. We used the alkaline comet assay, which is a highly sensitive method to assess DNA single-strand breaks and alkali-labile lesions. Blood samples were exposed to HPPP EMF for 40 min in rectangular wave guide. The specific absorption rate (SAR) calculated from temperature kinetics was about 1.6 kW/kg (peak SAR was about 300 MW/kg). The temperature rise in the blood samples at steady state was 3.5 +/- 0.1 degrees C. The data show that the increase in DNA damage after exposure of erythrocytes to HPPP EMF was induced by the rise in temperature in the exposed cell suspension. This was confirmed in experiments in which cells were incubated for 40 min under the corresponding temperature conditions. The results allow us to conclude that HPPP EMF-exposure at the given modality did not cause any a-thermal genotoxic effect on frog erythrocytes in vitro.
Descriptors: frog, *Xenopus laevis*, erythrocytes, DNA damage, electromagnetic fields, invitro exposure, high peak power pulse.

Chinchar, V.G., L. Bryan, U. Silphadaung, E. Noga, D. Wade, and L. Rollins Smith (2004). **Inactivation of viruses infecting ectothermic animals by amphibian and piscine antimicrobial peptides.** *Virology* 323(2): 268-275. ISSN: 0042-6822.
Descriptors: amphibian, piscine, viruses, ectothermic animals, antimicrobial peptides, virus inactivation.

Christensen, J.R., C.A. Bishop, J.S. Richardson, B. Pauli, and J. Elliott (2004). **Validation of an amphibian sperm inhibition toxicological test method using zinc.** *Environmental Toxicology and Chemistry* 23(12): 2950-2955. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58

Abstract: Analysis of sperm has been investigated as a possible method to examine the toxicity of environmental contaminants. The amphibian sperm inhibition toxicological test (ASITT) method examines the effects of contaminants on *Xenopus laevis* (African clawed frog) sperm motility and path trajectories. As part of a preliminary validation of the method, the effects of increasing divalent metal ion, zinc (Zn2+), on *X. laevis* sperm motility were examined. We hypothesized that Zn2+ concentration would have significant inhibitory effects on percent sperm motility, velocities, and trajectories. The Zn2+ was added to a control solution in concentrations from 0 to 1,417 microg/L. Sperm cells were videotaped at 30 frames per second under x 400 microscope, and percent motility was recorded and paths were mapped by marking the change in position of the sperm head over a period of 1 s. Sperm motility was categorized as progressive, hyperactivated, idle, or nonmotile, and velocities and trajectories were calculated on the basis of x,y coordinates. Increasing Zn2+ concentrations caused a significant exponential decay in percent total motility and progressive motility. Straight-line velocity increased with increasing Zn2+ concentrations. Overall, results suggest that Zn2+ may be interfering with cellular processes, such as cellular respiration, flagellar bending, or ion exchange, thereby inhibiting sperm motility.
Descriptors: amphibian, toad, *Xenopus laevis*, sperm motility, inhibition, toxicological tests methods, pollutants, zinc, chemical toxicity, reproducibility of results, .

Claas, B. and J. Dean (2006). **Prey-capture in the African clawed toad (*Xenopus laevis*): comparison of turning to visual and lateral line stimuli.** *Journal of Comparative Physiology A Sensory Neural and Behavioral Physiology* 192(10): 1021-1036. ISSN: 0340-7594.
NAL Call Number: QP33.J68
Abstract: Separately delivered visual and lateral line stimuli elicit similar but not identical orientation and approach by intact, sighted *Xenopus*. Response frequencies for visual stimuli declined sharply for distant or caudal stimuli while those for lateral line stimuli changed little. Turn angles correlated highly with stimulus angles but were smaller on average, so regression slopes were less than one. Regression slopes were smaller for visual than for lateral line stimuli, but this apparent difference was due to different distributions of stimulus distance interacting with the toad's rotation center. Errors in final headings, most often under-rotations, did not differ by modality. Frequencies of lunges and arm capture movements were higher for visual stimuli both overall and especially for rostral proximal stimuli. The results demonstrate accurate orientation by sighted *Xenopus* to visual and lateral line stimuli; they are consistent with expectations based on in-register tectal maps. Orientation to lateral line stimuli is similar to previous results with blinded animals, revealing no heightened acuity in the latter. Modality differences indicate that the lateral line system is better for omnidirectional orientation and approach to distant stimuli whereas the visual system is more attuned to nearby rostral stimuli and more apt to mediate strikes.
Descriptors: toad, pret capture, visual, lateral line, stimuli, response, sighted, blinded.

Cobellis, G., G. Cacciola, D. Scarpa, R. Meccariello, R. Chianese, M.F. Franzoni, K. Mackie, R. Pierantoni, and S. Fasano (2006). **Endocannabinoid system in frog and rodent testis: type-1 cannabinoid receptor and fatty acid amide hydrolase activity in male germ cells.** *Biology of Reproduction* 75(1): 82-89. ISSN: 0006-3363.

Online: http://dx.doi.org/10.1095/biolreprod.106.051730
Abstract: N-arachidonoylethanolamide (anandamide [AEA]) is the main endocannabinoid described to date in the testis. It exerts its effects through the activation of G-protein coupled cannabinoid receptors (CNR). However, the activity of AEA in controlling male reproduction is still poorly known. Here we provide direct evidence on the presence of the "endocannabinoid system," constituted by type-1 cannabinoid receptor (CNR1) and fatty acid amide hydrolase (FAAH), in the frog *Rana esculenta* testis demonstrating its expression in tubular compartment. In fact, during the annual reproductive cycle, both proteins increase in September, when the appearance of spermatids (SPT) occurs. Immunocytochemistry confirms their localization in germ cells and, in particular, in elongated SPT. Signals are still present in spermatozoa (SPZ), as demonstrated by Western blot analysis. Furthermore, the activation of CNR1 reduces sperm motility. Comparative research, carried out using mouse and rat SPZ, definitely indicates that the endocannabinoid system operates in SPZ of phylogenetically distant species. A conserved physiological role of endocannabinoid system in controlling the inhibition of sperm motility is suggested.
Descriptors: frog, *Rana esculenta*, rodent, testis, endocannabinoid dydtem, receptor, fatty acid, spermatids, germ cells.

Cobellis, G., M. Lombardi, D. Scarpa, G. Izzo, G. Fienga, R. Meccariello, R. Pierantoni, and S. Fasano (2005). **Fra1 activity in the frog, *Rana esculenta*, testis: A new potential role in sperm transport.** *Biology of Reproduction* 72(5): 1101-1108. ISSN: 0006-3363.
Online: http://dx.doi.org/10.1095/biolreprod.104.036541
NAL Call Number: QL876.B5
Abstract: Using an anti-Fos family member antibody, we have previously described in *Rana esculenta* testis the presence of a nuclear, 43 kDa protein that we hypothesized to be Fra1. With the assistance of an antibody against Fra1 that does not cross-react with other Fos family members, here we report data on Fra1 expression, localization, and putative activity in *Rana esculenta* testis during its annual reproductive cycle. Western blot analysis confirms that the nuclear, 43 kDa protein is Fra1. Immunocytochemistry validates the Western blot results and shows cytoplasmic and nuclear immunostaining of Fra1 in peritubular myoid cells, efferent ducts, and blood vessels. We report for the first time in a vertebrate, experimental evidence showing that the expression of Fra1 is related to peritubular myoid cells during sperm transport from the tubular compartment to efferent ducts.
Descriptors: frog, *Rana esculenta*, Fral activity, sperm transport, antibody, reproductive cycle, Western blot, efferent ducts.

Collins, J.P., J.L. Brunner, J.K. Jancovich, and D.M. Schock (2004). **A model host-pathogen system for studying infectious disease dynamics in amphibians: tiger salamanders (*Ambystoma tigrinum*) and *Ambystoma tigrinum* virus.** *Herpetological Journal* 14(4): 195-200. ISSN: 0268-0130.
Descriptors: amphibians, tiger salamanders, *Ambystoma tigrinum*, model host pathogen system, studying infectious disease, dynamics, virus.

Conlon, J.M. (2004). **The therapeutic potential of antimicrobial peptides from frog skin**. *Reviews in Medical Microbiology* 15(1): 17-25. ISSN: 0954-139X.
Descriptors: amphibians, *Xenopus laevis*, African clawed frog, frog skin, antimicrobial peptides, therapeutic potential.

Conlon, J.M., J. Kolodziejek, and N. Nowotny (2004). **Antimicrobial peptides from ranid frogs: taxonomic and phylogenetic markers and a potential source of new therapeutic agents.** *Biochimica Et Biophysica Acta* 1696(1): 1-14. ISSN: 0304-4165.
Abstract: Granular glands in the skins of frogs of the genus *Rana*, a widely distributed group with over 250 species, synthesize and secrete a remarkably diverse array of peptides with antimicrobial activity that are believed to have arisen as a result of multiple gene duplication events. Almost without exception, these components are hydrophobic, cationic and form an amphipathic alpha-helix in a membrane-mimetic solvent. The peptides can be grouped into families on the basis of structural similarity. To date, brevinin-1, esculentin-1, esculentin-2, and temporin peptides have been found in ranid frogs of both Eurasian and North American origin; ranalexin, ranatuerin-1, ranatuerin-2 and palustrin peptides only in N. American frogs; and brevinin-2, tigerinin, japonicin, nigrocin and melittin-related peptides only in Eurasian frogs. It is generally assumed that this structurally diversity serves to protect the organism against a wide range of pathogens but convincing evidence in support of this hypothesis is still required. The possibility that "antimicrobial peptides" fulfill additional or alternative biological functions should not be rejected. The molecular heterogeneity of the peptide families, particularly brevinin-1, brevinin-2 and ranatuerin-2, may be exploited for the purposes of unequivocal identification of specimens and for an understanding of phylogenetic interrelationships between species. The broad-spectrum antibacterial and antifungal activities of certain peptides, for example esculentin-1, ranalexin-1 and ranatuerin, together with their relatively low hemolytic activity, make them candidates for development into therapeutically useful anti-infective agents.
Descriptors: *Rana*, frogs, skins, granular glands, antimicrobial peptides, possible new therapeutic agents, anti infective agents.

Conlon, J.M., A. Sonnevend, C. Davidson, A. Demandt, and T. Jouenne (2005). **Host-defense peptides isolated from the skin secretions of the Northern red-legged frog *Rana aurora aurora*.** *Developmental and Comparative Immunology* 29(1): 83-90. ISSN: 0145-305X.
Descriptors: Northern red-legged frog *Rana aurora aurora*, antimicrobial cationic peptides, isolation and purification, bacteria drug effects, Ranidae immunology, skin chemistry, amino acid sequence, antimicrobial cationic peptides, immunology, pharmacology, chromatography, high pressure liquid, hemolysis, immunity, natural, molecular sequence data, norepinephrine pharmacology, ranidae metabolism, microbiology, skin secretion.

Conlon, J.M., N. Al Ghaferi, B. Abraham, Hu Jiansheng, P. Cosette, J. Leprince, T. Jouenne, and H. Vaudry (2006). **Antimicrobial peptides from diverse families isolated from the skin of the asian frog, *Rana grahami*.** *Peptides* 27(9): 2111-2117. ISSN: 0196-9781.
Descriptors: amphibians, Asian frog, *Rana grahami*, skin, antimicrobial peptides, skin extract, nigrocin, brevinin-1, brevinin-2, esculentin-1.

Cox, C.M., S.L. D'agostino, M.K. Miller, R.L. Heimark, and P.A. Krieg (2006). **Apelin, the ligand for the endothelial g-protein-coupled receptor, apj, is a potent angiogenic factor required for normal vascular development of the frog embryo**. *Developmental Biology* 296(1): 177-189. ISSN: 0012-1606.
Descriptors: amphibians, *Xenopus*, frog embryo, vascular development, apelin, peptide growth factor, angiogenic factor.

Crespi, E.J. and R.J. Denver (2006). **Physiological control of metamorphosis and growth in amphibians**. *Journal of Experimental Zoology* 305A(2): 119. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: 410 J825
Descriptors: amphibians, growth, metamorphosis, physiological control, meeting.
Notes: Meeting Information: 15th International Congress of Comparative Endocrinology, Boston, MA, USA; May 22 -27, 2005.

Daly, J.W., T.F. Spande, and H.M. Garraffo (2005). **Alkaloids from amphibian skin: a tabulation of over eight hundred compounds.** *Journal of Natural Products* 68(10): 1556-1575. ISSN: 0163-3864.
NAL Call Number: 442.8 L77
Descriptors: amphibians, skin, alkaloids, tabulation, eight hundred compounds.

Davis, A., L.B. Slusher, and J.T. Beneski (2002). **A novel method for the extraction and amplification of DNA from amphibians.** *Herpetological Review* 33(2): 104-105. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: amphibians, plethodontidae, cytogenetic techniques, DNA extraction, amplification technique, novel method, procedures, technique evaluation, nucleic acids, molecular genetics, DNA.

Davison, A.J., C. Cunningham, W. Sauerbier, and R.G. Mckinnell (2006). **Genome sequences of two frog herpesviruses**. *Journal of General Virology* 87(Part 12): 3509-3514. ISSN: 0022-1317.
Online: http://dx.doi.org/10.1099/vir.0.82291-0
NAL Call Number: QR360.A1J6
Descriptors: amphibians, herpesviruses, genome sequences, ranid herpesevirus 1, ranid herpesvirus 2, DNA, sequences.

Davit Beal, T., H. Chisaka, S. Delgado, and J.Y. Sire (2007). **Amphibian teeth: current knowledge, unanswered questions, and some directions for future research.** *Biological Reviews of the Cambridge Philosophical Society* 82(1): 49-81. ISSN: print: 1464-7931; online: 1469-185X.
Abstract: Elucidation of the mechanisms controlling early development and organogenesis is currently progressing in several model species and a new field of research, evolutionary developmental biology, which integrates developmental and comparative approaches, has emerged. Although the expression pattern of many genes during tooth development in mammals is known, data on other lineages are virtually non-existent. Comparison of tooth development,

and particularly of gene expression (and function) during tooth morphogenesis and differentiation, in representative species of various vertebrate lineages is a prerequisite to understand what makes one tooth different from another. Amphibians appear to be good candidates for such research for several reasons: tooth structure is similar to that in mammals, teeth are renewed continuously during life (=polyphyodonty), some species are easy to breed in the laboratory, and a large amount of morphological data are already available on diverse aspects of tooth biology in various species. The aim of this review is to evaluate current knowledge on amphibian teeth, principally concerning tooth development and replacement (including resorption), and changes in morphology and structure during ontogeny and metamorphosis. Throughout this review we highlight important questions which remain to be answered and that could be addressed using comparative morphological studies and molecular techniques. We illustrate several aspects of amphibian tooth biology using data obtained for the caudate Pleurodeles waltl. This salamander has been used extensively in experimental embryology research during the past century and appears to be one of the most favourable amphibian species to use as a model in studies of tooth development.
Descriptors: amphibia, salamander, anatomy, histology, tooth physiology, teeth, current knowledge, development, morphogenesis, animal model.

De Robertis, E.M. (2006). **Spemann's organizer and self-regulation in amphibian embryos.** *Nature Reviews. Molecular Cell Biology* 7(4): 296-302. ISSN: print: 1471-0072; online: 1471-0080.
Abstract: In 1924, Spemann and Mangold demonstrated the induction of Siamese twins in transplantation experiments with salamander eggs. Recent work in amphibian embryos has followed their lead and uncovered that cells in signalling centres that are located at the dorsal and ventral poles of the gastrula embryo communicate with each other through a network of secreted growth-factor antagonists, a protease that degrades them, a protease inhibitor and bone-morphogenic-protein signals.
Descriptors: amphibian embryology, cell communication, embryo, nonmammalian physiology, organizers, embryonic embryology, organizers, embryonic physiology, body patterning physiology, intralaminar thalamic nuclei transplantation, Siamese twins.

Del Pino, E.M., F.E. Saenz, O.D. Perez, F.D. Brown, M.E. Avila, V.A. Barragan, N. Haddad, M. Paulin Levasseur, and G. Krohne (2002). **Lamina-associated polypeptide 2 (LAP2) expression in fish and amphibians.** *International Journal of Developmental Biology* 46(2): 227-234. ISSN: 0214-6282.
Descriptors: fish, amphibians, proteins, lamina associated polypeptide 2, expression in somatic and germinal cells, comparative study.

Do Rego, J.L., S. Acharjee, J.Y. Seong, L. Galas, D. Alexandre, P. Bizet, A. Burlet, H.B. Kwon, V. Luu The, G. Pelletier, and H. Vaudry (2006). **Vasotocin and mesotocin stimulate the biosynthesis of neurosteroids in the frog brain.** *Journal of Neuroscience* 26(25): 6749-6760. ISSN: print: 0270-6474; online: 1529-2401.
Abstract: The neurohypophysial nonapeptides vasopressin (VP) and oxytocin (OT) modulate a broad range of cognitive and social activities. Notably, in amphibians, vasotocin

(VT), the ortholog of mammalian VP, plays a crucial role in the control of sexual behaviors. Because several neurosteroids also regulate reproduction-related behaviors, we investigated the possible effect of VT and the OT ortholog mesotocin (MT) in the control of neurosteroid production. Double immunohistochemical labeling of frog brain sections revealed the presence of VT/MT-positive fibers in close proximity of neurons expressing the steroidogenic enzymes 3beta-hydroxysteroid dehydrogenase/delta5-delta4 isomerase (3beta-HSD) and cytochrome P450 17alpha-hydroxylase/c17, 20-lyase (P450(C17)). High concentrations of VT and MT receptor mRNAs were observed in diencephalic nuclei containing the 3beta-HSD and P450(C17) neuronal populations. Exposure of frog hypothalamic explants to graded concentrations of VT or MT produced a dose-dependent increase in the formation of progesterone, 17-hydroxypregnenolone, 17-hydroxyprogesterone, and dehydroepiandrosterone. The stimulatory effect of VT and MT on neurosteroid biosynthesis was mimicked by VP and OT, as well as by a selective V1b receptor agonist, whereas V2 and OT receptor agonists had no effect. VT-induced neurosteroid production was completely suppressed by selective V1a receptor antagonists and was not affected by V2 and OT receptor antagonists. Concurrently, the effect of MT on neurosteroidogenesis was markedly attenuated by selective OT and V1a receptor antagonists but not by a V2 antagonist. The present study provides the first evidence for a regulatory effect of VT and MT on neurosteroid biosynthesis. These data suggest that neurosteroids may mediate some of the behavioral actions of VT and MT.
Descriptors: frog, *Rana esculenta*, brain drug effects, oxytocics pharmacology, oxytocin analogs and derivatives, steroids biosynthesis, vasotocin pharmacology, brain metabolism, chromatography, high pressure liquid methods, electrochemistry methods, immunohistochemistry methods, in situ hybridization methods, oxytocin pharmacology, rna, messenger biosynthesis, *Rana esculenta*, reverse transcriptase polymerase chain reaction methods.

Donald, J.A. and S. Trajanovska (2006). **A perspective on the role of natriuretic peptides in amphibian osmoregulation.** *General and Comparative Endocrinology* 147(1): 47-53. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: The natriuretic peptide (NP) system is a complex family of peptides and receptors that is primarily linked to the maintenance of osmotic and cardiovascular homeostasis. In amphibians, the potential role(s) of NPs is complicated by the range of osmoregulatory strategies found in amphibians, and the different tissues that participate in osmoregulation. Atrial NP, brain NP, and C-type NP have been isolated or cloned from a number of species, which has enabled physiological studies to be performed with homologous peptides. In addition, three types of NP receptors have been cloned and partially characterised. Natriuretic peptides are always potent vasodilators in amphibian blood vessels, and ANP has been shown to increase the permeability of the microcirculation. In the perfused kidney, ANP causes vasodilation, diuresis and natriuresis that are caused by an increased GFR rather than effects in the renal tubules. These data are supported by the presence of ANP receptors only on the glomeruli and renal blood vessels. In the bladder and skin, the function of NPs is enigmatic because physiological analysis of the effects of ANP on bladder and skin function has yielded conflicting data with no clear role for NPs being revealed. Overall, NPs often have no direct effect, but in some studies they have been shown to inhibit the function of AVT. In addi-

tion, there is evidence that ANP can inhibit salt retention in amphibians since it can inhibit the ability of adrenocorticotrophic hormone or angiotensin II to stimulate corticosteroid secretion. It is proposed that an important role for cardiac NPs could be in the control of hypervolaemia during periods of rapid rehydration, which occurs in terrestrial amphibians.
Descriptors: *Bufo marinus*, amphibian physiology, natriuretic peptides physiology, water electrolyte balance, amino acid sequence, amphibia blood, base sequence, brain metabolism, *Bufo marinus* genetics, models, biological, molecular sequence data, natriuretic peptides blood, natriuretic peptides chemistry, plasma volume, protein structure, secondary, sequence homology, amino acid.

Edginton, A.N., P.M. Sheridan, G.R. Stephenson, D.G. Thompson, and H.J. Boermans (2004). **Comparative effects of pH and Vision herbicide on two life stages of four anuran amphibian species.** *Environmental Toxicology and Chemistry* 23(4): 815-822. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Abstract: Vision, a glyphosate-based herbicide containing a 15% (weight:weight) poly-ethoxylated tallow amine surfactant blend, and the concurrent factor of pH were tested to determine their interactive effects on early life-stage anurans. Ninety-six-hour laboratory static renewal studies, using the embryonic and larval life stages (Gosner 25) of *Rana clamitans*, *R. pipiens*, *Bufo americanus*, and *Xenopus laevis*, were performed under a central composite rotatable design. Mortality and the prevalence of malformations were modeled using generalized linear models with a profile deviance approach for obtaining confidence intervals. There was a significant ($p < 0.05$) interaction of pH with Vision concentration in all eight models, such that the toxicity of Vision was amplified by elevated pH. The surfactant is the major toxic component of Vision and is hypothesized, in this study, to be the source of the pH interaction. Larvae of *B. americanus* and *R. clamitans* were 1.5 to 3.8 times more sensitive than their corresponding embryos, whereas *X. laevis* and *R. pipiens* larvae were 6.8 to 8.9 times more sensitive. At pH values above 7.5, the Vision concentrations expected to kill 50% of the test larvae in 96-h (96-h lethal concentration [LC50]) were predicted to be below the expected environmental concentration (EEC) as calculated by Canadian regulatory authorities. The EEC value represents a worst-case scenario for aerial Vision application and is calculated assuming an application of the maximum label rate (2.1 kg acid equivalents [a.e.]/ha) into a pond 15 cm in depth. The EEC of 1.4 mg a.e./L (4.5 mg/L Vision) was not exceeded by 96-h LC50 values for the embryo test. The larvae of the four species were comparable in sensitivity. Field studies should be completed using the more sensitive larval life stage to test for Vision toxicity at actual environmental concentrations.
Descriptors: amphibians, anuran, pH, Vision herbicide effects, two life stages, comparative effects, larval life stages.

El Sayed, M.F. (2002). **The effect of interaction between adrenaline and caffeine on the cardiac contractions developed after 5 minutes of rest in catfish and frog.** *Journal of the Egyptian German Society of Zoology* 37(A): 319-339. ISSN: 1110-5356.
NAL Call Number: QL1.E49
Descriptors: frog, catfish, neurotransmitters, heart beat, adrenaline and caffeine, interactive

effects, cardiac contractions.
Language of Text: Arabic; English.

Elepfandt, A. (2002). **Examination of underwater hearing and frequency discrimination in the clawed frog *Xenopus laevis laevis*.** *Bioacoustics* 12(2-3): 174-176. ISSN: 0952-4622.
Descriptors: clawed frog, *Xenopus laevis laevis* , sound reception, underwater hearing range, frequency discrimination abilities, sound, underwater sound.

Endepols, H., K. Roden, and W. Walkowiak (2005). **Hodological characterization of the septum in anuran amphibians: II. Efferent connections.** *Journal of Comparative Neurology* 483(4): 437-457. ISSN: 0021-9967.
Descriptors: anuran, amphibians, septum, efferent conections, hodological characterization.

Ewald, A.J., J.M. Tyszka, J. Wallingford, R. Harland, and S.E. Fraser (2003). **A three dimensional analysis of frog gastrulation.** *FASEB Journal* 17(Abstract No. 531.8): 4-5. ISSN: 0892-6638.
NAL Call Number: QH301.F3
Descriptors: amphibians, frog, gastrulation, three dimensional, analysis, meeting.
Notes: Meeting Information: FASEB Meeting on Experimental Biology: Translating the Genome, San Diego, CA, USA; April 11-15, 2003.

Ewert, J.P. and W.W. Schwippert (2006). **Modulation of visual perception and action by forebrain structures and their interactions in amphibians.** *EXS* 98: 99-136. ISSN: 1023-294X.
Descriptors: amphibian physiology, prosencephalon physiology, visual perception physiology.

Ewert, J.P. (2004). **Motion perception shapes the visual world of amphibians.** In: F.R. Prete (Editor), *Complex Worlds From Simpler Nervous Systems.,* MIT Press: Cambridge, MA, p. 117-160. ISBN: 0262162237.
NAL Call Number: QL785 .C545 2004
Descriptors: amphibians, shapes, visual world, motion perception, learning in animals.

Feng, A.S., P.M. Narins, C.H. Xu, W.Y. Lin, Z.L. Yu, Q. Qiu, Z.M. Xu, and J.X. Shen (2006). **Ultrasonic communication in frogs.** *Nature* 440(7082): 333-336. ISSN: print: 0028-0836; online: 1476-4687.
NAL Call Number: 472 N21
Abstract: Among vertebrates, only microchiropteran bats, cetaceans and some rodents are known to produce and detect ultrasounds (frequencies greater than 20 kHz) for the purpose of communication and/or echolocation, suggesting that this capacity might be restricted to mammals. Amphibians, reptiles and most birds generally have limited hearing capacity, with the ability to detect and produce sounds below approximately 12 kHz. Here we report evidence of ultrasonic communication in an amphibian, the concave-eared torrent frog (*Amolops tormotus*) from Huangshan Hot Springs, China. Males of *A. tormotus* produce diverse bird-like melodic calls with pronounced frequency modulations that often contain spectral energy in the ultrasonic range. To determine whether *A. tormotus* communicates

using ultrasound to avoid masking by the wideband background noise of local fast-flowing streams, or whether the ultrasound is simply a by-product of the sound-production mechanism, we conducted acoustic playback experiments in the frogs' natural habitat. We found that the audible as well as the ultrasonic components of an *A. tormotus* call can evoke male vocal responses. Electrophysiological recordings from the auditory midbrain confirmed the ultrasonic hearing capacity of these frogs and that of a sympatric species facing similar environmental constraints. This extraordinary upward extension into the ultrasonic range of both the harmonic content of the advertisement calls and the frog's hearing sensitivity is likely to have co-evolved in response to the intense, predominantly low-frequency ambient noise from local streams. Because amphibians are a distinct evolutionary lineage from microchiropterans and cetaceans (which have evolved ultrasonic hearing to minimize congestion in the frequency bands used for sound communication and to increase hunting efficacy in darkness), ultrasonic perception in these animals represents a new example of independent evolution.
Descriptors: bats, cetaceans, rodents, mammals, amphibians, reptiles, birds, concave-eared torrent frog, *Amolops tormotus*, animal communication, Ranidae physiology, ultrasonics, acoustic stimulation, brain physiology, ear physiology, evoked potentials, auditory physiology, evolution, hearing physiology, China.

Fernandes, M.S., H. Giusti, and M.L. Glass (2005). **An assessment of dead space in pulmonary ventilation of the toad *Bufo schneideri*.** *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 142(4): 446-450. ISSN: 1095-6433.
Descriptors: amphibians, toad, *Bufo schneideri*, pulmonary ventilation, dead space, assessment.

Filadelfi, A.M.C., A. Vieira, and F.M. Louzada (2005). **Circadian rhythm of physiological color change in the amphibian *Bufo ictericus* under different photoperiods.** *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 142(3): 370-375. ISSN: 1095-6433.
Descriptors: amphibians, toad, *Bufo ictericus*, circadian rhythm, physiological color change, different photoperiods.

Frehlick, L.J., J.M. Eirin Lopez, E.D. Jeffery, D.F. Hunt, and J. Ausio (2006). **The characterization of amphibian nucleoplasmins yields new insight into their role in sperm chromatin remodeling.** *BMC Genomics* 7: 99. ISSN: 1471-2164.
Online: http://dx.doi.org/10.1186/1471-2164-7-99
Abstract: BACKGROUND: Nucleoplasmin is a nuclear chaperone protein that has been shown to participate in the remodeling of sperm chromatin immediately after fertilization by displacing highly specialized sperm nuclear basic proteins (SNBPs), such as protamine (P type) and protamine-like (PL type) proteins, from the sperm chromatin and by the transfer of histone H2A-H2B. The presence of SNBPs of the histone type (H type) in some organisms (very similar to the histones found in somatic tissues) raises uncertainty about the need for a nucleoplasmin-mediated removal process in such cases and poses a very interesting question regarding the appearance and further differentiation of the sperm chromatin remodeling function of nucleoplasmin and the implicit relationship with SNBP diversity

The amphibians represent an unique opportunity to address this issue as they contain genera with SNBPs representative of each of the three main types: Rana (H type); Xenopus (PL type) and Bufo (P type). RESULTS: In this work, the presence of nucleoplasmin in oocyte extracts from these three organisms has been assessed using Western Blotting. We have used mass spectrometry and cloning techniques to characterize the full-length cDNA sequences of *Rana catesbeiana* and *Bufo marinus* nucleoplasmin. Northern dot blot analysis shows that nucleoplasmin is mainly transcribed in the egg of the former species. Phylogenetic analysis of nucleoplasmin family members from various metazoans suggests that amphibian nucleoplasmins group closely with mammalian NPM2 proteins. CONCLUSION: We have shown that these organisms, in striking contrast to their SNBPs, all contain nucleoplasmins with very similar primary structures. This result has important implications as it suggests that nucleoplasmin's role in chromatin assembly during early zygote development could have been complemented by the acquisition of a new function of non-specifically removing SNBPs in sperm chromatin remodeling. This acquired function would have been strongly determined by the constraints imposed by the appearance and differentiation of SNBPs in the sperm.
Descriptors: frog, *Xenopus*, chromatin chemistry, nuclear proteins chemistry, phosphoproteins chemistry, spermatozoa metabolism, base sequence, blotting, northern, bufonidae, chromatin metabolism, molecular sequence data, nuclear proteins metabolism, oocytes metabolism, phosphoproteins metabolism, phylogeny, Ranidae, species specificity.

Fuchs, C., T. Burmester, and T. Hankeln (2006). **The amphibian globin gene repertoire as revealed by the *Xenopus* genome.** *Cytogenetic and Genome Research* 112(3-4): 296-306. ISSN: print: 1424-8581; online: 1424-859X.
NAL Call Number: QH431.C95
Descriptors: amphibians, frog, *Xenopus tropicalis*, amphibian globin gene repertoire, *Xenopus* genome.

Fujimoto, K., K. Nakajima, and Y. Yaoita (2007). **Expression of matrix metalloproteinase genes in regressing or remodeling organs during amphibian metamorphosis.** *Development Growth and Differentiation* 49(2): 131-143. ISSN: 0012-1592.
Abstract: Several matrix metalloproteinases (MMP) are induced by thyroid hormone (TH) during the climax of amphibian metamorphosis and play a pivotal role in the remodeling of the intestine and the regressing tail and gills by degrading the extracellular matrix (ECM). We compared MMP gene expression levels precisely by quantitative real-time reverse transcription-polymerase chain reaction. The expression of MMP genes increases prominently at Nieuwkoop and Faber (NF) stages 60, 60-61 and 62 in the intestine, gills and tail, respectively, when the drastic morphological changes start in each organ. Gene expression analysis in the TH-treated tadpoles and cell line revealed that MMP mRNAs are upregulated in response to TH quickly within several hours to low levels and then increase in a day to high levels. All TH-induced MMP genes have TH response elements (TREs). The presence of high affinity TREs in MMP genes correlates with early TH-induction. Based on these results, we propose that TH stimulates the transcription of MMP genes through TREs within several hours to low levels and then brings about the main increase of mRNAs by TH-induced transcriptional factors, including TH receptor (Sb(B, in a cell type-specific transcriptional

environment.
Descriptors: *Xenopus*, amphibian metamorphosis, matrix metalloproteinase, thyroid hormone, thyroid hormone-response element, genes.

Gaitanaki, C., M. Papatriantafyllou, K. Stathopoulou, and I. Beis (2006). **Effects of various oxidants and antioxidants on the p38-MAPK signalling pathway in the perfused amphibian heart.** *Molecular and Cellular Biochemistry* 291(1): 107-117. ISSN: 0300-8177.
Abstract: We investigated the effects of different antioxidants such as L-ascorbic acid, catalase, and superoxide dismutase (SOD), on the p38-MAPK activation induced by oxidative stress in the isolated perfused amphibian heart. Oxidative stress was exemplified by perfusing hearts with 30 (So(BM H subscript 2(BO subscript 2(B for 5 min or with the enzymatic system of xanthine/xanthine oxidase (200 (So(BM/10 mU/ml, respectively) for 10 min. H subscript 2(BO subscript 2(B-induced activation of p38-MAPK (7.04 +/- 0.20-fold relative to control values) was totally attenuated by L-ascorbic acid (100 (So(BM) or catalase (150 U/ml). These results were confirmed by immunohistochemical studies in which the phosphorylated form of p38-MAPK was localised in the perinuclear region and dispersedly in the cytoplasm of the ventricular cells during H subscript 2(BO subscript 2(B treatment, a pattern that was abolished by catalase or L-ascorbic acid. p38-MAPK was also activated (2.34+/- 0.17-fold) by perfusing amphibian hearts with the reactive oxygen species (ROS)-generating system of xanthine/xanthine oxidase and this activation sustained in the presence of 150 U/ml catalase (2.16 +/- 0.26-fold), 50 U/ml SOD (2.02 +/-0.07) or 100 (So(BM L-ascorbic acid (2.18 +/- 0.10), but was suppressed by the combination of 150 U/ml catalase and 50 U/ml SOD. Finally, our studies showed that xanthine/xanthine oxidase induced the phosphorylation of the potent p38-MAPK substrates MAPKAPK2 (3.14 +/- 0.27-fold) and HSP27 (5.32 +/- 0.83-fold), which are implicated in cell protection, and this activation was reduced by the simultaneous use of catalase and SOD.
Descriptors: amphibians, antioxidants, oxidative stress, signal transduction, xanthine oxidase, amphibian heart, HSP27, p38 MAPK, *Rana ridibunda*.

Gall, J.G., Z. Wu, C. Murphy, and H. Gao (2004). **Structure in the amphibian germinal vesicle.** *Experimental Cell Research* 296(1): 28-34. ISSN: 0014-4827.
NAL Call Number: 442.8 Ex7
Abstract: The germinal vesicle (GV) of *Xenopus laevis* is an enormous nucleus that contains 18 giant lampbrush chromosomes and thousands of inclusions. The inclusions are primarily of three types: approximately 1500 extrachromosomal nucleoli, 50-100 Cajal bodies, and several thousand B-snurposomes, which correspond to speckles or interchromatin granule clusters in other nuclei. The large size and abundance of the GV organelles, as well as the ease with which they can be studied both in vivo and in vitro, make the GV an ideal object for analysis of nuclear structure and function.
Descriptors: amphibia, *Xenopus laevis*, cell nucleus ultrastructure, oocytes ultrastructure, cell nucleolus, cell nucleus physiology, germinal vesicle, ultrastructure, chromosomes.

Gargaglioni, L.H. and L.G.S. Branco (2004). **Nucleus isthmi and control of breathing in amphibians.** *Respiratory Physiology and Neurobiology* 143(2-3): 177-186. ISSN: 1569-9048.
NAL Call Number: QP121.A1 R4
Descriptors: amphibians, nucleus isthmi, control of breathing, respiratory function.

Giacometti, A., O. Cirioni, R. Ghiselli, F. Mocchegiani, C. Silvestri, F. Orlando, W. Kamysz, A. Licci, E. Kamysz, J. Lukasiak, V. Saba, and G. Scalise (2006). **Amphibian peptides prevent endotoxemia and bacterial translocation in bile duct-ligated rats.** *Critical Care Medicine* 34(9): 2415-2420. ISSN: print: 0090-3493; online: 1530-0293.
Abstract: OBJECTIVE: To investigate the efficacy of amphibian antimicrobial peptides in preventing bacterial translocation and neutralizing endotoxins in bile duct-ligated rats. DESIGN: Prospective, randomized, controlled animal study. SETTING: Research laboratory in a university hospital. SUBJECTS: Adult male Wistar rats. INTERVENTIONS: Adult male Wistar rats underwent sham operation or bile duct ligation (BDL). Eight groups were studied: sham operation with saline treatment, sham operation with 120 mg/kg tazobactam-piperacillin, sham operation with 2 mg/kg uperin 3.6, sham operation with 2 mg/kg magainin2, BDL with saline treatment, BDL with 120 mg/kg tazobactam-piperacillin, BDL with 2 mg/kg uperin 3.6, and BDL with 2 mg/kg magainin2. MEASUREMENTS AND MAIN RESULTS: Main outcome measures were: endotoxin and tumor necrosis factor-alpha concentrations in plasma and evidence of bacterial translocation in blood, peritoneum, liver, and mesenteric lymph nodes. Endotoxin and tumor necrosis factor-alpha plasma levels were significantly higher in BDL rats compared with sham-operated animals. All amphibian peptides achieved a significant reduction of plasma endotoxin and tumor necrosis factor-alpha concentration when compared with saline- and tazobactam-piperacillin-treated groups. On the other hand, both tazobactam-piperacillin and peptides significantly reduced bacterial growth compared with the control. Tazobactam-piperacillin and magainin2 exerted the maximal inhibition of bacterial growth. CONCLUSION: In conclusion, because of their multifunctional properties, amphibian peptides could be interesting compounds to inhibit bacterial translocation and endotoxin release in obstructive jaundice.
Descriptors: amphibian proteins pharmacology, anti infective agents pharmacology, antimicrobial cationic peptides pharmacology, bacterial translocation drug effects, jaundice, obstructive microbiology, peptides pharmacology, *Xenopus* proteins pharmacology, bacteremia, bile ducts surgery, endotoxins blood, *Enterococcus faecalis* physiology, enzyme inhibitors pharmacology, *Escherichia coli* physiology, ligation, liver microbiology, lymph nodes microbiology, penicillanic acid analogs and derivatives, penicillanic acid pharmacology, peritoneum microbiology, piperacillin pharmacology, prospective studies, random allocation, rats, rats, wistar, tumor necrosis factor alpha analysis, beta lactamases antagonists and inhibitors.
Notes: Comment On: Crit Care Med. 2006 Sep;34(9):2503-4.

Gillette, J.R. (2002). **Odor discrimination in the California slender salamander, *Batrachoseps attenuatus*: Evidence for self-recognition.** *Herpetologica* 58(2): 165-170. ISSN: 0018-0831.
NAL Call Number: QL640.H4
Descriptors: salamander, *Batrachoseps attenuatus*, chemoreception, odor discrimination, scent marking, species recognition, self-recognition.

Godfrey, E.W. and G.E. Sanders (2004). **Effects of water hardness on oocyte quality and embryo development in the African clawed frog (*Xenopus laevis*).** *Comparative Medicine* 54(2): 170-175. ISSN: 1532-0820.
NAL Call Number: SF77.C65
Descriptors: clawed frog, *Xenopus*, embryogenesis, ova, embryonic mortality, water hardness, effects, embryo development.

Goense, J.B.M. and A.S. Feng (2005). **Seasonal changes in frequency tuning and temporal processing in single neurons in the frog auditory midbrain.** *Journal of Neurobiology* 65(1): 22-36. ISSN: 0022-3034.
NAL Call Number: QP351.J55
Descriptors: amphibians, frog, auditory midbrain, frequency tuning, temporal processing, single neurons, seasonal changes , acoustic signaling.

Goldberg, C.S., M.E. Kaplan, and C.R. Schwalbe (2003). **From the frog's mouth: buccal swabs from collection of DNA from amphibians.** *Herpetological Review* 34(3): 220-221. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: frogs, mouth, buccal swabs, DNA collection, amphibians, method.

Gomez Mestre, I. and M. Tejedo (2003). **Local adaptation of an anuran amphibian to osmotically stressful environments.** *Evolution* 57(8): 1889-1899. ISSN: 0014-3820.
Descriptors: amphibian, anuran, osmotically stressful environments, salinity, brackish water, fresh water, adaptations.

Gonzalez Elorrlaga, M.A. and G. Canepa (2002). **Evidencias que sugieren una asociacion microanatomica mastocito-nervio en la lengua del sapo *Bufo marinus* demostradas mediante microscopia de luz de alta resolucion. [Suggestive evidences for a microanatomical relationship between mast cells and nerve in the tongue of the toad *Bufo marinus* demonstrated by means of high resolution light microscopy.]**. *Acta Cientifica Venezolana* 53(4): 258-265. ISSN: 0001-5504.
Descriptors: toad, *Bufo marinus*, mast cells, nerve, tongue, microanatomical relationship, high resolution light microscopy.
Language of Text: Spanish; Summary in English and Spanish.

Goodman, G. (2003). **Oral biology and conditions of amphibians.** *Veterinary Clinics of North America, Exotic Animal Practice* 6(3): 467-475. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Descriptors: amphibians, oral biology, conditions, diseases, tongue, mouth.

Gotoh, Y., K. Kashiwagi, S. Kawakami, N. Huruno, M. Yamashita, and A. Kashiwagi (2005). **High gravity inhibits embryonic development of amphibians**. *Zoological Science* 22(12): 1473. ISSN: 0289-0003.
NAL Call Number: QL1.Z68
Descriptors: amphibnians, embryonic development, high gravity, inhibits, meeting.

Notes: Meeting Information: 76th Annual Meeting of the Zoological Society of Japan, Tsukuba, Japan; October 6-8, 2005.

Grace, M.S. and S. McMahon (2004). **Circadian rhythms in reptiles and amphibians.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 11: 77-84. ISSN: 1529-9651.
Online: http://www.arav.org/
NAL Call Number: SF996.A77
Descriptors: amphibians, reptiles, circadian rhythms, conference proceedings.

Grant, J.B. and B. Land (2002). **Transcutaneous amphibian stimulator (TAS): a device for the collection of amphibian skin secretions.** *Herpetological Review* 33(1): 38-41. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: amphibians, biochemical techniques, histological techniques, skin secretions, collection technique.

Gray, M.M., C.J. Hoskin, and C. Bardeleben (2006). **Isolation of polymorphic tetranucleotide microsatellite markers for the green-eyed tree frog (*Litoria genimaculata*).** *Molecular Ecology Notes* 6(3): 859-861. ISSN: 1471-8278.
Abstract: We have isolated 16 polymorphic microsatellite markers for the green-eyed tree frog, *Litoria genimaculata*, from genomic libraries enriched for (AAGG)n and (AAAG)n repetitive elements. The number of alleles ranges from four to 14 per locus with the observed heterozygosity ranging from 0.36 to 1.00. These markers will be useful for analysis of questions concerning population genetic structure and speciation.
Descriptors: tree frog, *Litoria genimaculata*, microsatellite markers, polymorphic, alleles, locus, genomic libraries, population genetics.

Green, D.M. (2004). **Structure and evolution of B chromosomes in amphibians.** *Cytogenetic and Genome Research* 106(2-4): 235-242. ISSN: 1424-8581.
NAL Call Number: QH431.C95
Descriptors: amphibians, chromosomes, B chromosomes, structure, evolution.

Gross, M.L., W. Hanke, A. Koch, H. Ziebart, K. Amann, and E. Ritz (2002). **Intraperitoneal protein injection in the axolotl: the amphibian kidney as a novel model to study tubulointerstitial activation**. *Kidney International* 62(1): 51-59. ISSN: 0085-2538.
Descriptors: amphibians, kidney, novel model, tubulointerstitial activation, urinary system, axolotl, intraperitoneal protein injection.

Harada, Y., S. Kasuga, and S. Tamura (2002). **Comparison of the morphology of the inner ear between newts and frogs in relation to their locomotory capability.** *Zoological Science* 19(5): 583-592. ISSN: 0289-0003.
NAL Call Number: QL1.Z68
Descriptors: frogs, *Rana nigromaculata*, newts, *Cynops pyrrhogaster*, salamander, ear, inner ear, ultrastructure, locomotory capability, relations.

Hasegawa, M., Y. Suzuki, and S. Wada (2005). **Design and performance of a wet sponge model for amphibian thermal biology.** *Current Herpetology* 24(1): 27-32. ISSN: 1345-5834.
Descriptors: amphibians, wet sponge model for amphibian thermal biology, temperature, thermal biology.

Hauswaldt, J.S., C. Schroder, and R. Tiedemann (2007). **Nine new tetranucleotide microsatellite markers for the fire-bellied toad (*Bombina bombina*).** *Molecular Ecology Notes* 7(1): 49-52. ISSN: 1471-8278.
Abstract: We describe nine new polymorphic tetranucleotide microsatellite loci isolated from the fire-bellied toad (*Bombina bombina*). The relative yield of new loci was higher than described in previous studies in amphibians: out of 12 loci initially evaluated, nine were polymorphic and amplifying reliably. Number of alleles ranged from four to 10 and observed heterozygosities from 0.47 to 0.91. Seven loci were polymorphic also in *Bombina variegata* and five in *Bombina orientalis*. Enrichment protocols yielding long flanking regions potentially overcome difficulties (i.e, low yield of reliable loci relative to number of clones screened) which have been reported in microsatellite development in anurans.
Descriptors: toad, fire-bellied toad (*Bombina bombina*), *Bombina variegata*, *Bombina orientalis*, microsatellite markers, polymorphic tetranucleotide, loci, alleles, anurans.

Hayashi, S., T. Osawa, and K. Tohyama (2002). **Comparative observations on corneas, with special reference to Bowman's layer and Descemet's membrane in mammals and amphibians.** *Journal of Morphology* 254(3): 247-258. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: amphibians, mammals, cornea, comparative observations, Bowman's layer and Descemet's membrane.

Heikkila, J.J. (2004). **Regulation and function of small heat shock protein genes during amphibian development.** *Journal of Cellular Biochemistry* 93(4): 672-680. ISSN: 0730-2312.
Abstract: Small heat shock proteins (shsps) are molecular chaperones that are inducible by environmental stress such as elevated temperature or exposure to heavy metals or arsenate. Recent interest in shsps has been propelled by the finding that shsp synthesis or mutations are associated with various human diseases. While much is known about shsps in cultured cells, less is known about their expression and function during early animal development. In amphibian model systems, shsp genes are developmentally regulated under both normal and environmental stress conditions. For example, in *Xenopus*, the shsp gene family, hsp30, is repressed and not heat-inducible until the late neurula/early tailbud stage whereas other hsps are inducible at the onset of zygotic genome activation at the midblastula stage. Furthermore, these shsp genes are preferentially induced in selected tissues. Recent studies suggest that the developmental regulation of these shsp genes is controlled, in part, at the level of chromatin structure. Some shsps including *Xenopus* and hsp30 are synthesized constitutively in selected tissues where they may function in the prevention of apoptosis. During environmental stress, amphibian multimeric shsps bind to denatured target protein, inhibittheir aggregation and maintain them in a folding-competent state until reactivated by other cellular chaperones. Phosphorylation of shsps appears to play a major role in the regulation of their function.

Descriptors: *Xenopus*, *Rana*, amphibian development, small heat shock protein genes, shsps, regulation, function, environmental stress, elevated temperature.

Hertwig, S., R.O. De Sa, and A. Haas (2004). **Phylogenetic signal and the utility of 12S and 16S mtDNA in frog phylogeny.** *Journal of Zoological Systematics and Evolutionary Research* 42(1): 2-18. ISSN: 0947-5745.
Descriptors: amphibians, frog, Anura, frog phylogeny, phylogenetic signal, utility, 12S, 16S, mtDNA, genes.
Language of Text: English; German.

Hillyard, S.D., J. Goldstein, W. Tuttle, and K. Hoff (2004). **Transcellular and paracellular elements of salt chemosensation in toad skin.** *Chemical Senses* 29(9): 755-762. ISSN: 0379-864X.
Descriptors: *Bufo punctatus*, toad, skin, salt chemosensation, transcellular, paracellular, elements in skin.

Hirai, K., E. Tanaka, I. Motelica heino, Y. Katayama, H. Higashi, and S. Tsuji (2006). **A new cytochemical method for in situ detection of cholinergic synaptic transmission by staining of Cu2+ incorporated in frog neuromuscular junction during nerve stimulation.** *Biomedical Research* 27(3): 125-130. ISSN: 0388-6107.
Abstract: A new cytochemical method was devised in order to visualize Cu2+ ions in the synaptic area after their intracellular penetration during nerve stimulation of the frog neuromuscular junction (NMJ). The motor nerves were stimulated in presence of Cu2+. After total blockade of the neuromuscular junction, the tissue was treated by ferrocyanide, a precipitating agent of Cu2+, and fixed for optical and electron microscopic observation. The oxidoreductase-like catalytic activity of the copper ferrocyanide precipitate was used to amplify the cytochemical staining by a treatment with diaminobenzidine and H2O2, after permeabilization of cell membranes by Triton X-100. At optical level, an intense staining was observed in the synaptic area. Application of d-tubocurarine (d-TC), a selective inhibitor of nicotinic acetylcholine receptors (nAChRs), markedly reduced the staining. No reaction could be observed in absence of membrane permeabilization. These results suggest that Cu2+ was localized in the cytoplasm of muscle cells after its penetration through nAChRs. At electron microscopic level, cytochemical reaction was found in the cytoplasm of muscle cells near the postsynaptic membrane, and in a few synaptic vesicles in the vicinity of the active zone. This method may be used for the identification of cholinergic inputs in central and peripheral nerve systems and, generally speaking, for the detection of synaptic activity elicited by specific nerve stimulation.
Descriptors: frog, copper pharmacology, neuromuscular junction pathology, neurons metabolism, receptors, nicotinic metabolism, synaptic transmission, 3,3' diaminobenzidine pharmacology, copper metabolism, cytoplasm metabolism, detergents pharmacology, ferrocyanides pharmacology, hydrogen peroxide pharmacology, immunohistochemistry, microscopy, electron, nicotinic antagonists pharmacology, octoxynol pharmacology, Ranidae.

Ho, C.C.K. and P.M. Narins (2006). **Directionality of the pressure-difference receiver ears in the northern leopard frog, *Rana pipiens pipiens*.** *Journal of Comparative Physiology A Sensory Neural and Behavioral Physiology* 192(4): 417-429. ISSN: 0340-7594.
NAL Call Number: QP33.J68
Descriptors: northern leopard frog, *Rana pipiens pipiens*, receiver ears, directionality, pressure difference, eardrum system.

Hochedlinger, K. and R. Jaenisch (2002). **Nuclear transplantation: lessons from frogs and mice**. *Current Opinion in Cell Biology* 14(6): 741-748. ISSN: 0955-0674.
Descriptors: frogs, mice, nuclear transplantation, lessons, cloning.

Hou, J.h., B.c. Zhu, Y.w. Dong, P.q. Li, H.m. Liu, and X.q. Wang (2004). **Research advances of Chinese giant salamander, *Andrias davidianus*.** *Sichuan Journal of Zoology* 23(3): 262-266, 276. ISSN: 1000-7083.
Descriptors: amphibians, *Andrias davidianus*, giant salamander, research advances, China.
Language of Text: Chinese; Summary in Chinese and English.

Hudson, N.J., M.B. Bennett, and C.E. Franklin (2004). **Effect of aestivation on long bone mechanical properties in the green-striped burrowing frog, *Cyclorana alboguttata*.** *Journal of Experimental Biology* 207(3): 475-482. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.00787
NAL Call Number: 442.8 B77
Abstract: T
Descriptors: green striped burrowing frog, *Cyclorana alboguttata*, estivation, long bone mechanical properties, skeleton, effect of estivation on mechanical properties.

Hudson, N.J. and C.E. Franklin (2002). **Maintaining muscle mass during extended disuse: aestivating frogs as a model species.** *Journal of Experimental Biology* 205(15): 2297-2303. ISSN: 0022-0949.
NAL Call Number: 442.8 B77
Descriptors: estivating frogs, model species, muscle mass, maintaining, literature review, dormancy, muscle maintenance, musculature, muscle maintenance during extended disuse, review.

Hudson, N.J. and C.E. Franklin (2003). **Preservation of three-dimensional capillary structure in frog muscle during aestivation.** *Journal of Anatomy* 202(5): 471-474. ISSN: 0021-8782.
Descriptors: frog, estivation, frog muscle, structure, three diensional capillary structure, preservation during estivation.

Inoue, A. and H. Akiyoshi (2005). **Comparative histological study of the hepatic architecture in amphibian livers in relation to phylogeny**. *Zoological Science* 22(12): 1437. ISSN: 0289-0003.
NAL Call Number: QL1.Z68
Descriptors: amphibians, comparative histological study, hepatic architecture, livers, phylogony, meeting.

Notes: Meeting Information: 76th Annual Meeting of the Zoological Society of Japan, Tsukuba, Japan; October 6-8, 2005.

Jiang, L.L. and D.J. Shang (2004). **Antimicrobial activity of skin antimicrobial peptide in Chinese forest frogs.** *Chinese Journal of Zoology* 39(6): 70-72. ISSN: 0250-3263.
Descriptors: Chinese forest frogs, skin, antimicrobial peptide, antimicrobial activity, bacteria.
Language of Text: Chinese; Summary in Chinese and English.

Jin, S., M.C. Cornwall, and D.D. Oprian (2003). **Transgenic frogs and the molecular mechanism of congenital night blindness.** *Biophysical Journal* 84(2 Part 2): 270a. ISSN: 0006-3495.
Descriptors: amphibians, transgenic frogs, sense organs, night blindness, congenital disease, eye disease, molecular mechanism.
Notes: Meeting Information: 47th Annual Meeting of the Biophysical Society, San Antonio, TX, USA; March 1-5, 2003.

Johansson, L.C. and G.V. Lauder (2004). **Hydrodynamics of surface swimming in leopard frogs (*Rana pipiens*).** *Journal of Experimental Biology* 207(Pt 22): 3945-3958. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01258
NAL Call Number: 442.8 B77
Abstract: The kinematics of swimming frogs have been studied extensively in the past and, based on these results, hypotheses regarding the hydrodynamics of frog swimming can be generated. To test these hypotheses we used digital particle image velocimetry (DPIV) to quantify the flow structure of the wake produced by the feet during the propulsion phase of the kick of surface swimming frogs (*Rana pipiens*). These frogs use two different gaits, asynchronous and synchronous kicking, and the magnitude of the thrust produced by the feet differs between asynchronous (34+/-5.4 mN foot(-1)) and synchronous kicking (71+/-13.3 mN foot(-1)), as does maximum swimming speed, with higher swimming speed and forces produced during the synchronous kicks. Previous studies have suggested that an interaction between the feet, resulting in a single posteriorly directed fluid jet, as the feet come together at the end of synchronous kicks, may augment force production. Our results show, however, that each foot produces its own distinct vortex ring, in both asynchronous and synchronous kicking of the feet. There is no evidence of a central jet being produced even during powerful synchronous kicks (maximum thrust calculated was 264 mN foot(-1)). An alternative mechanism of force production could be the lift-based paddling recently suggested for delta-shaped feet of swimming birds. However, the orientation of the vortex rings generated by the feet is almost perpendicular to the swimming direction for both gaits and there is only a slight asynchrony of the shedding of the distal (start) and proximal (stop) vortex rings, which is different from what would be expected by a dominantly lift-based mechanism. Thus, our results do not support lift as a major mechanism contributing to thrust. Instead, our data support the hypothesis that propulsion is based on drag and acceleration reaction forces where the thrust is generated by separated, but attached, vortex rings on the suction side of the feet, resulting in vortices that are shed behind the frogs during both asynchronous and synchronous kicking.

Descriptors: leopard frogs, *Rana pipiens*, surface swimming, hydrodynamics, kinematics, gaits, kicking, propulsion, thrust.

Kashiwagi, K., H. Hanada, H. Kubo, T. Shinkai, H. Fujii, M. Yamashita, T. Naito, and A. Kashiwagi (2002). **Effects of gravity during amphibian metamorphosis.** *Zoological Science* 19(12): 1458. ISSN: 0289-0003.
NAL Call Number: QL1.Z68
Descriptors: amphibians, gravity, effects, metamorphosis, development, meeting.
Notes: Meeting Information: Seventy-Third Annual Meeting of the Zoological Society of Japan, Kanazawa, Japan; September 24-27, 2002.

Katayama, M., H. Yoshizawa, K. Matsuda, and M. Uchiyama (2003). **Regulation of body fluid and the structure of kidneys in japanese arboreal frog, *Rhacophorus arboreus*.** *Zoological Science* 20(12): 1575. ISSN: 0289-0003.
NAL Call Number: QL1.Z68
Descriptors: amphibians, arboreal frog, kidney structure, body fluid regulation, Japan, meeting.
Notes: Meeting Information: Proceedings of the Seventy Fourth Annual Meeting of the Zoological Society of Japan, Hakodate, Japan; September 17-19, 2003.

Katbamna, B., J.A. Brown, M. Collard, and C.F. Ide (2006). **Auditory brainstem responses to airborne sounds in the aquatic frog *Xenopus laevis*: correlation with middle ear characteristics**. *Journal of Comparative Physiology A Neuroethology Sensory Neural and Behavioral Physiology* 192(4): 381-387. ISSN: 0340-7594.
NAL Call Number: QP33.J68
Descriptors: amphibians, frog, *Xenopus laevis*, airborn sound, auditory brainstem responses, aquatic frogs, middle ear characteristics, hearing sensitivity.

Kauer, J.S. (2002). **On the scents of smell in the salamander.** *Nature* 417(6886): 336-342. ISSN: 0028-0836.
NAL Call Number: 472 N21
Descriptors: amphibians, salamander, literature review, biochemistry, nervous system, chemoreception, olfactory processing, review.

Kawakami, S., K. Kashiwagi, N. Furuno, M. Yamashita, and A. Kashiwagi (2006). **Effects of hypergravity environments on amphibian development, gene expression and apoptosis**. *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 145(1): 65-72. ISSN: 1095-6433.
Descriptors: amphibians, frog, *Xenopus laevis*, hypergravity environments, effects, development, gene expression, apoptosis, brain, eyes.

Kawakami, S., K. Kashiwagi, A. Kashiwagi, N. Furuno, Y. Gotoh, M. Yamashita, and Y. Tanimoto (2005). **Effect of a high magnetic field on amphibians** . *Zoological Science* 22(12): 1473. ISSN: 0289-0003.
NAL Call Number: QL1.Z68

Descriptors: amphibians, high magnetic field, effect, meeting.
Notes: Meeting Information: 76th Annual Meeting of the Zoological Society of Japan, Tsukuba, Japan; October 6-8, 2005.

Kawamura, K., T. Kouki, G. Kawahara, and S. Kikuyama (2002). **Hypophyseal development in vertebrates from amphibians to mammals.** *General and Comparative Endocrinology* 126(2): 130-135. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: amphibians, vertebrates, literature review, pituitary gland, hypophyseal development, origins, phylogenetic considerations, phylogeny, pituitary developmental aspects, review.

Kikuyama, S., T. Nakada, F. Toyoda, T. Iwata, K. Yamamoto, and J.M. Conlon (2005). **Amphibian pheromones and endocrine control of their secretion.** *Annals of the New York Academy of Sciences* 1040: 123-130. ISSN: 0077-8923.
NAL Call Number: 500 N484
Descriptors: amphibians, phermones, secretions, endocrine control, breeding.

Kikuyama, S., K. Yamamoto, T. Iwata, and F. Toyoda (2002). **Peptide and protein pheromones in amphibians.** *Comparative Biochemistry and Physiology Part B Biochemistry and Molecular Biology* 132B(1): 69-74. ISSN: 1096-4959.
Descriptors: amphibians, Anura, urodel, proteins, reproductive behavior, pheromones, peptide and protein sex pheromones, purification, characterization, biological activity, review.

Kikuyama, S., K. Yamamoto, T. Kobayashi, M.C. Tonon, L. Galas, and H. Vaudry (2005). **Hormonal regulation of growth in amphibians.** *Amphibian Biology* 6: 2267-2300. ISSN: 0386-3166.
Descriptors: amphibians, hormonal regulation, growth, review.

Klenk, K. and N. Komar (2003). **Poor replication of West Nile virus (New York 1999 strain) in three reptilian and one amphibian species.** *American Journal of Tropical Medicine and Hygiene* 69(3): 260-262. ISSN: 0002-9637.
Online: http://www.ajtmh.org/cgi/content/abstract/69/3/260?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&author1=klenk%2C+k&fulltext=west+nile&searchid=1&FIRSTINDEX=0&sortspec=relevance&resourcetype=HWCIT
Descriptors: West Nile virus, NY 1999 strain, poor replication, three reptilian species, one amphibian species.

Kloas, W. (2002). **Amphibians as a model for the study of endocrine disruptors.** In: K.W. Jeon (Editor), *International Review of Cytology: A Survey of Cell Biology,* Vol. 216, p. 1-57. ISBN: 978-0-12-364620-0.
Online: http://dx.doi.org/10.1016/S0074-7696(02)16002-5
Descriptors: amphibians, endocrine disrupters, study model, book chapter.

Kloas, W. and I. Lutz (2006). **Amphibians as model to study endocrine disrupters**. *Journal of Chromatography A* 1130(1, Sp. Iss. SI): 16-27. ISSN: 0021-9673.
Descriptors: amphibians, animal model, endocrine disrupters, pharmacology, endocrine system, reproductive system, bioassay, thyroid system.

Komazaki, S. (2004). **Gravitational effects on apoptosis of presumptive ectodermal cells of amphibian embryo.** *Journal of Experimental Zoology. Part A, Comparative Experimental Biology* 301(3): 204-211. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Descriptors: amphibian embryo, gravitational effects, apoptosis, ectodermal cells.

Kosik Bogacka, D.I. and T. Tyrakowski (2007). **Effect of hibernation on sodium and chloride ion transport in isolated frog skin**. *Folia Biologica* 55(1-2): 47-51. ISSN: 0015-5500.
Descriptors: amphibians, frog, sodium and chloride ion transport, isolated frog skin, hibernation, effect.

Kuffler, D.P., A. Lyfenko, L. Vyklicky, and V. Vlachova (2002). **Cellular mechanisms of nociception in the frog**. *Journal of Neurophysiology* 88(4): 1843-1850. ISSN: 0022-3077.
Descriptors: amphibians, frog, nociception, *Rana pipiens*, cellular mechanisms, defense reactions, neurons, temperature.

Laberge, F., S. Muhlenbrock Lenter, W. Grunwald, and G. Roth (2006). **Evolution of the amygdala: new insights from studies in amphibians.** *Brain, Behavior and Evolution* 67(4): 177-187. ISSN: 0006-8977.
Abstract: The histology of amphibian brains gives an impression of relative simplicity when compared with that of reptiles or mammals. The amphibian telencephalon is small and contains comparatively few and large neurons, which in most parts constitute a dense periventricular cellular layer. However, the view emerging from the last decade is that the brains of all tetrapods, including amphibians, share a general bauplan resulting from common ancestry and the need to perform similar vital functions. To what extent this common organization also applies to higher brain functions is unknown due to a limited knowledge of the neurobiology of early vertebrates. The amygdala is widely recognized as a brain center critical for basic forms of emotional learning (e.g., fear conditioning) and its structure in amphibians could suggest how this capacity evolved. A functional systems approach is used here to synthesize the results of our anatomical investigations of the amphibian amygdala. It is proposed that the connectivity of the amphibian telencephalon portends a capacity for multi-modal association in a limbic system largely similar to that of amniote vertebrates. One remarkable exception is the presence of new sensory-associative regions of the amygdala in amniotes: the posterior dorsal ventricular ridge plus lateral nuclei in reptiles and the basolateral complex in mammals. These presumably homologous regions apparently are capable of modulating the phylogenetically older central amygdala and allow more complex forms of emotional learning.
Descriptors: amphibia physiology, amygdala physiology, evolution, limbic system physiology, thalamus cytology, thalamus physiology.

Lai, R., J.g. Liang, and Y. Zhang (2004). **Antimicrobial peptides in amphibian skins and their application.** *Zoological Research* 25(5): 465-468. ISSN: 0254-5853.
NAL Call Number: QL1.T85
Descriptors: amphibians, amphibian skins, antimicrobial properties, application.
Language of Text: Chinese; Summary in Chinese and English.

Lai, R., D.m. Yang, W.H. Lee, and Y. Zhang (2002). **Biological activities of skin secretions of the salamander *Tylototriton verrucosus*.** *Journal of Natural Toxins* 11(3): 245-250. ISSN: 1058-8108.
Descriptors: amphibians, salamander, *Tylototriton verrucosus*, biochemistry, skin, secretions, biological activities, immune response.

Lardner, B. and J. Loman (2003). **Growth or reproduction? Resource allocation by female frogs *Rana temporaria*.** *Oecologia Berlin* 137(4): 541-546. ISSN: 0029-8549.
Descriptors: frogs, female, *Rana temporaria*, resource allocation, growth, reproduction.

Layne, J.R.J. and S.D. Kennedy (2002). **Cellular energetics of frozen wood frogs (*Rana sylvatica*) revealed via NMR spectroscopy.** *Journal of Thermal Biology* 27(3): 167-173. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: amphibians, frog, *Rana sylvatica*, ion and water relations, intracellular ph, temperature relationships, freeze tolerance, cellular energetics, nucleic acids, ATP and creative phosphate, temperature.

Layne, J.R.J. and M.E. Rice (2003). **Postfreeze locomotion performance in wood frogs (*Rana sylvatica*) and spring peepers (*Pseudacris crucifer*).** *Canadian Journal of Zoology* 81(12): 2061-2065. ISSN: 0008-4301.
NAL Call Number: 470 C16D
Descriptors: wood frogs, spring peepers, *Rana sylvatica*, *Pseudacris crucifer*, post freeze locomotion performance.
Language of Text: English; French.

Liu, J.y., Y.a. Tan, Q.s. Tan, X.l. He, Y.c. Zhang , and M.g. Liu (2006). **Research on Chinese giant salamander F2 adaptability and growth advantages.** *Sichuan Journal of Zoology* 25(2): 387-390 . ISSN: 1000-7083.
Descriptors: amphibians, Chinese giant salamander, adaptability, growth advantages, research.
Language of Text: Chinese; Summary in Chinese and English.

Liu, J.Y., J.P. Jiang, F. Xie, and Z.H. Zheng (2004). **Structure and antimicrobial peptides of amphibian skin.** *Chinese Journal of Zoology* 39(1): 112-116. ISSN: 0250-3263.
Descriptors: amphibians, skin, structure, antimicrobial peptides.
Language of Text: Chinese; Summary in Chinese and English.

Liu, Y., X.c. Li, and D. Yu (2005). **High osmotic endurance of tadpole of common giant toad.** *Sichuan Journal of Zoology* 24(3): 432-435. ISSN: 1000-7083.
Descriptors: common giant toad, *Bufo bufo gargarizans*, high osmotic endurance, tadpole.
Language of Text: Chinese; Summary in Chinese and English.

Logares, R.E. and C.A. Ubeda (2006). **First insights into the overwintering biology of alsodes gargola frogs and tadpoles inhabiting harsh Andean-Patagonia alpine environments**. *Amphibia Reptilia* 27(2): 263-267. ISSN: 0173-5373.
Descriptors: amphibians, alsodes gargola frogs, overwintering biology, insights, tadpoles, harsh alpine environments.

Loi, P., J.J. Fulka, and G. Ptak (2003). **Amphibian and mammal somatic-cell cloning: different species, common results?** *Trends in Biotechnology* 21(11): 471-473. ISSN: 0167-7799.
NAL Call Number: TA166.T72
Descriptors: sheep, mammals, Amphibia, cloning (animals), chromatin, somatic cell.

Lu, Y.y., J. Wang, X.h. Liu, Z.y. Zhou, X.z. Chen, X.a. Wang, P. Zhang, and P.p. Li (2004). **Microstructure of skin of Fischer's clawed salamander (*Onychodactylus fischeri*).** *Sichuan Journal of Zoology* 23(3): 178-182. ISSN: 1000-7083.
Descriptors: Fisher's clawed salamander, *Onychodactylus fischeri*, skin, microstructure, capillaries.
Language of Text: Chinese; Summary in Chinese and English.

Mali, L.B. and B. Bulog (2004). **Histology and ultrastructure of the gut epithelium of the neotenic cave salamander, *Proteus anguinus* (Amphibia, Caudata).** *Journal of Morphology* 259(1): 82-89. ISSN: 0362-2525.
NAL Call Number: 444.8 J826
Descriptors: amphibians, neotenic cave salamander, *Proteus anguinus*, gut epithelium, histology, ultrastructure.

Marenah, L., P.R. Flatt, D.F. Orr, C. Shaw, and Y.H.A. Abdel Wahab (2006). **Skin secretions of *Rana saharica* frogs reveal antimicrobial peptides esculentins-1 and-1b and brevinins-1e and-2ec with novel insulin releasing activity**. *Journal of Endocrinology* 188(1): 1-9. ISSN: 0022-0795.
Online: http://dx.doi.org/10.1677/joe.1.06293
NAL Call Number: 448.8 J8293
Descriptors: amphibians, *Rana saharica*, frogs, skin secretions, antimicrobial peptides, esculentin-1, brevinin-1E, esculentin-1B, bnevinin-2EC.

Marvin, G.A. (2003). **Aquatic and terrestrial locomotor performance in a semiaquatic plethodontid salamander (*Pseudotriton ruber*): Influence of acute temperature, thermal acclimation, and body size.** *Copeia* 2003(4): 704-713. ISSN: 0045-8511.
Descriptors: plethodontid salamander, *Psuedotriton ruber*, aquatic and terrestrial locmotor performance, acute temperature, thermal acclimation, effect, body size.

Marvin, G.A., R.R. Whitekiller, and V.H. Hutchison (2004). **Avoidance of alarm chemicals by plethodontid salamanders (genus *Eurycea*): Importance of phylogeny, ecology, and methodology.** *Herpetologica* 60(1): 24-33. ISSN: 0018-0831.
NAL Call Number: QL640.H4
Descriptors: amphibians, plethodontid salamanders, *Eurcea*, alarm chemicals, avoidance, phylogeny, ecology, methodology, importance.

Mason, M.J. (2007). **Pathways for sound transmission to the inner ear in amphibians**. In: *Springer Handbook of Auditory Research.* Vol. 28, 147-183, Springer: New York, NYISBN: 0387325212.
Descriptors: amphibians, sound transmission, pathways, inner ear, sensory system, hearing, book chapter.

McAllister, K.R., J.W. Watson, K. Risenhoover, and T. McBride (2004). **Marking and radiotelemetry of Oregon spotted frogs (*Rana pretiosa*).** *Northwestern Naturalist* 85(1): 20-25. ISSN: 1051-1733.
NAL Call Number: QL671.M8
Descriptors: Oregon spotted frogs, *Rana pretiosa*, marking, radiotelemetry, methods, evaluation, USA.

Meyers, J.J., J.C. O'Reilly, J.A. Monroy, and K.C. Nishikawa (2004). **Mechanism of tongue protraction in microhylid frogs.** *Journal of Experimental Biology* 207(1): 21-31. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.00715
NAL Call Number: 442.8 B77
Descriptors: microhylid frogs, tongue protraction, mechanism, muscle denervation, videography.

Moreno, N. and A. Gonzalez (2004). **Localization and connectivity of the lateral amygdala in anuran amphibians.** *Journal of Comparative Neurology* 479(2): 130-148. ISSN: print: 0092-7317; online: 1550-7130.
Descriptors: amphibians, anuran, lateral amygdala, localization, connectivity.

Morizot, D.C., K.J. Kochan, and D.A. Wright (2002). **Comparative gene mapping in amphibians.** *Gene Families and Isozymes Bulletin* 35: 12-32. ISSN: 0197-887X.
Descriptors: amphibians, comparative gene mapping.

Morse, R.P. and E.F. Evans (2003). **The sciatic nerve of the toad *Xenopus laevis* as a physiological model of the human cochlear nerve.** *Hearing Research* 182(1-2): 97-118. ISSN: 0378-5955.
Descriptors: amphibians, toad, *Xenopus laevis*, sciatic nerve, physiological research animal model, human cochlear nerve.

Mosconi, G., O. Carnevali, M.F. Franzoni, E. Cottone, I. Lutz, W. Kloas, K. Yamamoto, S. Kikuyama, and A.M. Polzonetti Magni (2002). **Environmental estrogens and reproductive biology in amphibians.** *General and Comparative Endocrinology* 126(2): 125-129. ISSN:

0016-6480.
NAL Call Number: 444.8 G28
Descriptors: amphibians, *Xenopus laevis*, *Triturus carnifex*, sex determination, sexual differentiation, chemical factors, 4 nonyl phenol, sexual differentiation effects, overview.

Mouchet, F., L. Gauthier, C. Mailhes, V. Ferrier, and A. Devaux (2005). **Comparative study of the comet assay and the micronucleus test in amphibian larvae (*Xenopus laevis*) using benzo(a)pyrene, ethyl methanesulfonate, and methyl methanesulfonate: establishment of a positive control in the amphibian comet assay.** *Environmental Toxicology* 20(1): 74-84. ISSN: 1520-4081.
NAL Call Number: RA1221.T69
Descriptors: frogs, *Xenopus laevis*, pollutants, genotoxicity, biomarkers, toxicity testing, bioassays, DNA damage, screening, dose response.

Muths, E. (2003). **A radio transmitter belt for small ranid frogs.** *Herpetological Review* 34(4): 345-348. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: small ranid frogs, *Rana sylvatica*, radio telemetry, radio transmitter belt.

Nakamura, M. and N. Osawa (2006). **Expression of genes required for sex determination and differentiation in amphibians**. *Journal of Experimental Zoology, Part A Comparative Experimental Biology.* 305A(2): 160. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: QL1.J854
Descriptors: amphibians, sex determination, differentiation, expression of genes required, meeting.
Notes: Meeting Information: 15th International Congress of Comparative Endocrinology, Boston, MA, USA; May 22 -27, 2005.

Naya, D., R. Maneyro, A. Camargo, A. Canavero, and I. Da Rosa (2003). **Seasonal changes in gut length of the South American common frog *Leptodactylus ocellatus* (Amphibia, Anura)**. *Biociencias* 11(1): 47-52. ISSN: 0104-3455.
Descriptors: amphibians, common frog, *Leptodactylus ocellatus*, gut length, seasonal changes, changes in feeding activity, female, male, prey contents.

Ogurtsov, S.V. (2004). **Olfactory orientation in anuran amphibians.** *Russian Journal of Herpetology* 11(1): 35-40. ISSN: 1026-2296.
Descriptors: amphibians, anurans, olfactory orientation, odors, smell.

Oishi, T., K. Nagai, Y. Harada, M. Naruse, M. Ohtani, E. Kawano, and S. Tamotsu (2004). **Circadian rhythms in amphibians and reptiles: ecological implications.** *Biological Rhythm Research* 35(1-2): 105-120. ISSN: 0929-1016.
Descriptors: amphibians, reptiles, circadian rhythms, ecological implications.

Okada, R., Y. Ito, K. Yamamoto, and S. Kikuyama (2006). **Identification of thyrotropin-releasing factor in amphibians**. *Frontiers in Neuroendocrinology* 27(1): 155. ISSN: 0091-3022.
NAL Call Number: QL187.A1F7
Descriptors: amphibians, thyrotropin releasing factor, identification.
Notes: Meeting Information: 6th International Congress of Neuroendocrinology, Pittsburgh, PA, USA; June 19 -22, 2006.

Okuda Akabane, K., H. Fukami, K. Narita, and Y. Kitada (2006). **Membrane excitability of wing and rod cells in frog taste discs following denervation.** *Brain Research* 1103(1): 145-149. ISSN: 0006-8993.
Abstract: The frog tongue has a disc-shaped taste organ (taste disc) on the top of fungiform papillae. The taste disc contains two types of cells, wing cells with a sheet-like apical process and rod cells with a rod-like apical process. Both wing and rod cells can produce action potentials. Unlike the taste buds of mammals, frog taste discs do not degenerate over a long period after denervation. Here we report that the shapes of wing and rod cells isolated from taste discs in the bullfrog (*Rana catesbeiana*) remained unchanged 1 month after cutting bilateral glossopharyngeal nerves. By applying the whole cell patch-clamp technique to isolated wing and rod cells, we found voltage-dependent inward currents and outward currents and action potentials in denervated frogs as seen in normal frogs. These results suggest that the maintenance of morphological integrity and electrical excitability of taste cells does not require a nerve supply in frogs.
Descriptors: frog, *Rana catesbeiana*, neurons, afferent physiology, taste physiology, tongue innervation, action potentials physiology, cell membrane physiology, cell separation, cell shape, denervation, electric stimulation, glossopharyngeal nerve physiology, ion channel gating physiology, membrane potentials physiology, neurons, afferent ultrastructure, patch clamp techniques, potassium physiology, sodium channels physiology.

Olsson, L. (2003). **Cell migration, pattern formation and cell fate during head development in lungfishes and amphibians.** *Theory in Biosciences* 122(2-3): 252-265. ISSN: 1431-7613.
Descriptors: amphibians, lung fishes, cell migration, pattern formation, cell fate, during head development.

Ortiz Santaliestra, M.E., A. Marco, M.J. Fernandez, and M. Lizana (2006). **Influence of developmental stage on sensitivity to ammonium nitrate of aquatic stages of amphibians**. *Environmental Toxicology and Chemistry* 25(1): 105-111. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Descriptors: amphibians, develpmental stage, influence, sensitivity, ammonium nitrate, aquatic stages, effect, embryonic, larval.

Oshima, H., R. Miyazaki, Y. Ohe, H. Hayashi, K. Kawamura, and S. Kikuyama (2002). **Isolation and sequence of a novel amphibian pancreatic chitinase.** *Comparative Biochemistry and Physiology Part B Biochemistry and Molecular Biology* 132(2): 381-388. ISSN: 1096-4959.
Abstract: An approximately 60-kDa protein with chitinase activity was purified from the pancreas of the toad *Bufo japonicus*. Its specific activity was 4.5 times higher than that of

a commercial bacterial chitinase in fragmenting crab shell chitin, and its optimal pH was approximately 6.0. A cDNA clone encoding a protein consisting of 488 amino acid residues, including part of the peptide sequence determined from the isolated protein, was obtained from a toad pancreas cDNA library. The deduced amino acid sequence indicated that the protein contained regions with high homology to those present in chitinases from different species, with the amino acid residues for the chitinase activity and the chitin-binding ability being completely conserved. We designate the protein as toad pancreatic chitinase (tPCase). Northern blot analysis revealed the mRNA of this enzyme to be expressed exclusively in the pancreas. Toad PCase is the first amphibian chitinase to be identified as well as the first pancreatic chitinase identified in a vertebrate.
Descriptors: amphibian, toad, *Bufo japonicus*, pancreatic chitinase, isolation, sequence.

Pakkasmaa, S., J. Merila, and R.B. O'Hara (2003). **Genetic and maternal effect influences on viability of common frog tadpoles under different environmental conditions.** *Heredity* 91(2): 117-124. ISSN: 0018-067X.
Descriptors: amphibians, common frog tadpoles, genetic, maternal, influences, viability, different environmental conditions.

Palo, J.U. and J. Merila (2003). **A simple RFLP method for identification of two ranid frogs.** *Conservation Genetics* 4(6): 801-803. ISSN: 1566-0621.
NAL Call Number: QH75.A1 C56
Descriptors: two ranid frogs, simple RFLP method for identification.

Peinado, J.R., J.P. Castano, R. Vazquez Martinez , Y. Anouar, M.C. Tonon, H. Vaudry, F. Gracia Navarro, and M.M. Malagon (2002). **Amphibian melanotrophs as a model to analyze the secretory plasticity of endocrine cells.** *General and Comparative Endocrinology* 126(1): 4-6. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: amphibians, pituitary gland, intermediate lobe melanotrophs, secretory plasiticity models, review.

Pereira, C.N., I. Di Rosa, A. Fagotti, F. Simoncelli, R. Pascolini, and L. Mendoza (2005). **The pathogen of frogs *Amphibiocystidium ranae* is a member of the order Dermocystida in the class Mesomycetozoea.** *Journal of Clinical Microbiology* 43(1): 192-198. ISSN: 0095-1137.
Online: http://dx.doi.org/10.1128/JCM.43.1.192-198.2005
NAL Call Number: QR46.J6
Abstract: The pathogen of frogs *Amphibiocystidium ranae* was recently described as a new genus. Due to its spherical shape, containing hundred of endospores, it was thought to be closely related to the pathogens of fish, mammals, and birds known as Dermocystidium spp., *Rhinosporidium seeberi*, and *Sphaerothecum destruens* in the Mesomycetozoea, but further studies were not conducted to confirm this relationship. To investigate its phylogenetic affinities, total genomic DNA was extracted from samples collected from infected frogs containing multiple cysts (sporangia) and endospores. The universal primers NS1 and NS8, used to amplify the 18S small-subunit rRNA by PCR, yielded [approximately]1,770-bp amplicons.

Sequencing and basic local alignment search tool analyses indicated that the 18S small-subunit rRNA of *A. ranae* from both *Rana esculenta* and *Rana lessonae* was closely related to all of the above organisms. Our phylogenetic analysis placed this pathogen of frogs as the sister group to the genus Dermocystidium and closely related to RHINOSPORIDIUM: These data strongly supported the placement of the genus Amphibiocystidium within the mesomycetozoeans, which is in agreement with the phenotypic features that *A. ranae* shares with the other members of this class. Interestingly, during this study *Dermocystidium percae* did not group within the Dermocystidium spp. from fish; rather, it was found to be the sister group to *Sphaerothecum destruens*. This finding suggests that *D. percae* could well be a member of the genus Sphaerothecum or perhaps represents a new genus.
Descriptors: amphibians, frogs, *Amphibiocystidium ranae*, pathogens, endospores, Mesomycetozoea, Sphaerothecum.

Perez Leon, J.A., E. Lopez Vera, and R. Salceda (2004). **Pharmacological properties of glycine transport in the frog retina.** *Neurochemical Research* 29(1): 313-318. ISSN: print: 0364-3190; online: 1573-6930.
Abstract: The high-affinity glycine transport in neurons and glial cells is the primary means for inactivating synaptic glycine. Two different glycine transporter genes, Glyt-1 and Glyt-2, have been cloned. Glyt-1 has been reported to occur in the retina, but there is no evidence for expression of the Glyt-2 transporter. We have pharmacologically characterized glycine transport in the frog retina. 3H-Glycine uptake in the retina was insensitive to modulation by phorbol esters or changes in cAMP levels, and was partially inhibited by sarcosine. Differential sensitivity of glycine transport to sarcosine was exhibited by synaptosomal fractions from the inner and outer plexiform layers of the frog retina. The Na+ Hill coefficient of glycine uptake was 2.0, as has been reported for Glyt-2. In addition, amoxapine, a specific inhibitor of the Glyt-2a isoform, reduced by 60% glycine uptake by P2 synaptosomal fraction. Our results indicate the presence of different glycine transporter isoforms in the frog retina, acting mainly through the classical inhibitory glycine system.
Descriptors: amphibians, frog, retina, glycine trasnsport, pharmacological properties, glial cells, Glyt-1, Glyt-2, glycine uptake.

Pichon, F. and A. Ghysen (2004). **Evolution of posterior lateral line development in fish and amphibians.** *Evolution and Development* 6(3): 187-193. ISSN: print: 1520-541X; online: 1525-142X.
Abstract: The lateral line is a sensory system present in fish and amphibians. It is composed of discrete sense organs, the neuromasts, arranged on the head and body in species-specific patterns. The neuromasts are deposited by migrating primordia that originate from pre- and postotic placodes and follow defined pathways on the head and body. Here we examine the formation of the posterior lateral line (PLL), which extends rostrocaudally on the trunk and tail. In amphibians, the PLL neuromasts are deposited as a single wave from the head to the tip of the tail. In the zebrafish, however, the first wave of neuromast deposition forms but a rudimentary PLL, and several additional waves are needed to form the adult pattern. We show that the amphibian mode is also present in the sturgeon and therefore probably represents the primitive mode, whereas the zebrafish mode is highly conserved in several teleost

species. A third mode is found in a subgroup of teleosts, the protacanthopterygians, and may represent a synapomorphy of this group. Altogether, the mode of formation of the embryonic PLL appears to have undergone remarkably few changes during the long history of anamniote evolution, even though large differences can be observed in the lateral line morphology of adult fishes.
Descriptors: amphibians, posterior lateral line, development, fish, evolution, sensory system, sense organs, neuromasts.

Pidancier, N., C. Miquel, and C. Miaud (2003(2004) October). **Buccal swabs as a non-destructive tissue sampling method for DNA analysis in amphibians.** *Herpetological Journal* 13(4): 175-178. ISSN: 0268-0130.
Descriptors: amphibians, buccal swabs, tissue sampling method, non destructive, DNA analysis.

Pierantoni, R., G. Cobellis, R. Meccariello, C. Palmiero, G. Fienga, S. Minucci, and S. Fasano (2002). **The amphibian testis as model to study germ cell progression during spermatogenesis.** *Comparative Biochemistry and Physiology Part B Biochemistry and Molecular Biology* 132(1): 131-139. ISSN: 1096-4959.
Abstract: Testicular morphology of vertebrate testis indicates requirement of local control. In urodeles, the testis is organized in lobes of increasing maturity throughout the cephalocaudal axis. The anuran testis is organized in tubules. Spermatogenesis occurs in cysts composed by Sertoli cells enveloping germ cells at synchronous stages. Moreover, in numerous species germ cell progression lasts a year which defines the sexual cycle. Due to the above quoted features, research on factors regulating germ cell progression in amphibians may reach greater insight as compared with mammalian animal models. In particular, studies on endocrine and paracrine/autocrine factors involved in the regulation of germ cell functions reveal that fos activation and a J protein, previously specifically found in mouse testis, exert an important role in spermatogonial proliferation and maturation of post-meiotic stages, respectively.
Descriptors: amphibian, testis, germ cell progression, spermatogenesis, testicular morphology, vertebrate testis.

Plane, S.J. and S.J. Warburton (2002). **High catecholamine environment: developmental cardiac effects in the amphibian, *Xenopus laevis*.** *FASEB Journal* 16(5): A886. ISSN: print: 0892-6638; online: 1530-6860.
NAL Call Number: QH301.F3
Descriptors: amphibians, frog, *Xenopus laevis*, developmental cardiac effects, high catecholamine environment, chronic epinephrine esposure, meeting.
Notes: Meeting Information: Annual Meeting of Professional Research Scientists on Experimental Biology, New Orleans, Louisiana, USA; April 20-24, 2002.

Ponti, D., M.L. Mangoni, G. Mignogna, M. Simmaco, and D. Barra (2003). **An amphibian antimicrobial peptide variant expressed in *Nicotiana tabacum* confers resistance to phytopathogens.** *Biochemical Journal.* 370(Pt 1): 121-127. ISSN: print: 0264-6021; online: 1470-8728.

Abstract: Esculentin-1 is a 46-residue antimicrobial peptide present in skin secretions of *Rana esculenta*. It is effective against a wide variety of micro-organisms, including plant pathogens with negligible effects on eukaryotic cells. As a possible approach to enhance plant resistance, a DNA coding for esculentin-1, with the substitution Met-28Leu, was fused at the C-terminal end of the leader sequence of endopolygalacturonase-inhibiting protein, under the control of the cauliflower mosaic virus 35S promoter region, and introduced into *Nicotiana tabacum*. The antimicrobial peptide was isolated from the intercellular fluids of healthy leaves of transgenic plants, suggesting that it was properly processed, secreted outside cells and accumulated in the intercellular spaces. The morphology of transgenic plants was unaffected. Challenging these plants with bacterial or fungal phytopathogens demonstrated enhanced resistance up to the second generation. Moreover, transgenic plants displayed insecticidal properties.
Descriptors: amphibians, antimicrobial peptide, resistance, phytopathogens, transgenic plants, skin secretions, frog, *Rana esculenta*, plant pathogens, cauliflower mosaic virus.

Pukala, T.L., J.H. Bowie, V.M. Maselli, I.F. Musgrave, and M.J. Tyler (2006). **Host-defence peptides from the glandular secretions of amphibians: structure and activity.** *Natural Product Reports* 23(3): 368-393. ISSN: print: 0265-0568; online: 1460-4752.
Descriptors: amphibia, amphibian proteins chemistry, proteins genetics, metabolism, secretion, antimicrobial cationic peptides chemistry, peptides genetics, peptides metabolism, peptides secretion, amino acid sequence, evolution, molecular sequence data.

Qiao, Z.g., X.j. Li, X.y. Li, and C.s. Xu (2004). **Effects of temperature, light and preservative fluid on the survival of spermatozoa in Chinese giant salamander (*Andrias davidianus*).** *Fisheries Science Liaoning* 23(3): 10-12. ISSN: 1003-1111.
Descriptors: Chinese giant salamander, *Andrias davidianus*, effects, temeperature, light, preservative fluid, survival of spermatazoa.
Language of Text: Chinese; Summary in Chinese and English.

Rajchard, J. (2006). **Antipredator pheromones in amphibians: A review**. *Veterinarni Medicina* 51(8): 409-413. ISSN: 0375-8427.
Online: http://www.vri.cz/docs/vetmed/51-8-409.pdf
NAL Call Number: 41.9 C333
Descriptors: amphibians, antipredator pheromones, behavior, vermonasal system, chemosignals, tadpoles, *Rana*, literature review.

Rankouhi, T.R., J.T. Sanderson, I.v. Holsteijn, P.v. Kooten, A.T.C. Bosveld, and M.v.d. Berg (2005). **Effects of environmental and natural estrogens on vitellogenin production in hepatocytes of the brown frog (*Rana temporaria*).** *Aquatic Toxicology* 71(1): 97-101. ISSN: 0166-445X.
NAL Call Number: QH541.5.W3A6
Abstract: The objective of this study was to investigate the ability of the natural estrogens and synthetic estrogens as well as the estrogen mimics to induce estrogen-receptor mediated vitellogenesis in primary hepatocytes of the brown frog (*Rana temporaria*). Based on

EC50 values the following order was determined for the potency of the estrogens: 17beta-estradiol (EC50: 19-43 nM) approximately equal to ethynylestradiol (EC50: 13-80 nM) > estrone (EC50: 218-241 nM) > DES (EC50: 338-3537 nM). Exposure to bisphenol A and methoxychlor concentrations up to 100 micromolar did not have any effect on in vitro vitellogenesis.
Descriptors: *Rana temporaria*, frogs, hepatocytes, estrogens, pollutants, xenobiotics, toxic substances, estradiol, estrone, diethylstilbestrol, methoxychlor, hormone agonists, endocrine disrupting chemicals, vitellogenesis, vitellogenin, in vitro studies, median effective concentration, 17 beta estradiol, bisphenol, ethynylestradiol, Netherlands.

Rodney, G.G., G.M. Wilson, and M.F. Schneider (2005). **A calmodulin binding domain of RyR increases activation of spontaneous Ca superscript 2+ sparks in frog skeletal muscle.** *Journal of Biological Chemistry* 280(12): 11713-11722. ISSN: 0021-9258.
Online: http://dx.doi.org/10.1074/jbc.M408189200
NAL Call Number: 381 J824
Abstract: The calmodulin C lobe binding region (residues 3614-3643) on the sarcoplasmic reticulum Ca superscript 2+ release channel (RyR1) is thought to be a region of contact between subunits within RyR1 homotetramer Ca superscript 2+ release channels. To determine whether the 3614-3643 region is a regulatory site/interaction domain within RyR in muscle fibers, we have investigated the effect of a synthetic peptide corresponding to this region (R3614-3643) on Ca superscript 2+ sparks in frog skeletal muscle fibers. R3614-3643 (0.2-3.0 [micro]M) promoted the occurrence of Ca superscript 2+ sparks in a highly cooperative dose-dependent manner, with a half-maximal activation at 0.47 [micro]M and a maximal increase in frequency of [approximately]5-fold. A peptide with a single amino acid substitution within R3614-3643 (L3624D) retained the ability to bind Ca superscript 2+-free calmodulin but did not increase Ca superscript 2+ spark frequency, suggesting that R3614-3643 does not modulate Ca superscript 2+ sparks by removal of endogenous calmodulin. Our data support a model in which the calmodulin binding domain of RyR1 modulates channel activity by at least two mechanisms: direct binding of calmodulin as well as interactions with other regions of RyR.
Descriptors: frog, skeletal muscle, calmodulin binding, RyR increases, spontaneous Ca superscript 2+.

Rollins Smith, L.A., J.D. King, P.F. Nielsen, A. Sonnevend, and J.M. Conlon (2005). **An antimicrobial peptide from the skin secretions of the mountain chicken frog *Leptodactylus fallax* (Anura:Leptodactylidae).** *Regulatory Peptides* 124(1-3): 173-178. ISSN: 0167-0115.
Abstract: A 25 amino-acid-residue, C-terminally alpha-amidated peptide with antimicrobial activity, which has been termed fallaxin, was isolated in high yield from the norepinephrine-stimulated skin secretions of the mountain chicken frog *Leptodactylus fallax* (Anura:Leptodactylidae). The amino acid sequence of the peptide (Gly-Val-Val-Asp-Ile-Leu-Lys-Gly-Ala-Ala-Lys-Asp-Ile-Ala-Gly-His-Leu-Ala-Ser-Lys-Val-Met-Asn-Lys-Leu.NH2) shows structural similarity with members of the ranatuerin-2 family previously isolated from the skins of frogs of the genus Rana that are only distantly related to the Leptodactylidae. This observation is consistent with the hypothesis that many frog skin antimicrobial peptides

are related evolutionarily, having arisen from multiple duplications of an ancestral gene that existed before the radiation of the different families. Fallaxin inhibited the growth of reference strains of Gram-negative bacteria (*Escherichia coli*, *Pseudomonas aeruginosa*, *Enterobacter cloacae*, *Klebsiella pneumoniae*) but with relatively low potency (MIC> or =20 microM) and was inactive against the Gram-positive bacterium (*Staphylococcus aureus*) and the yeast *Candida albicans*. The hemolytic activity of fallaxin was very low (HC50>200 microM). A second peptide, comprising residues (1-22) of fallaxin, was also isolated from the skin secretions but this component was inactive against the microorganisms tested.
Descriptors: frog, *Leptodactylus fallax*, antimicrobial cationic peptides pharmacology, secretion, anura metabolism, skin secretion, amino acid sequence, antimicrobial cationic peptides chemistry, isolation and purification, chromatography, gel , chromatography, high pressure liquid, erythrocytes drug effects, hemolysis drug effects, molecular sequence data, sequence alignment, skin chemistry.

Rollins Smith, L.A., D.C. Woodhams, L.K. Reinert , V.T. Vredenburg, C.J. Briggs, P.F. Nielsen, and J. Michael Conlon (2006). **Antimicrobial peptide defenses of the mountain yellow-legged frog (*Rana muscosa*).** *Developmental and Comparative Immunology* 30(9): 831-842. ISSN: 0145-305X.
Abstract: The mountain yellow-legged frog (*Rana muscosa*) inhabits high elevation lakes in California that are largely undisturbed by human activities. In spite of this habitation in remote sites, populations continue to decline. Although predation by non-native fish is one cause for declines, some isolated populations in fishless lakes are suffering new declines. One possible cause of the current wave of declines is the introduction of the pathogenic chytrid fungus (*Batrachochytrium dendrobatidis*) which invades the adult skin to cause chytridiomycosis. In many amphibian species, the skin is protected by antimicrobial peptides secreted into the mucous. Here we show that *R. muscosa* produces three previously unknown antimicrobial peptides belonging to the ranatuerin-2 and temporin-1 families of antimicrobial peptides. These three peptides, along with bradykinin, are the most abundant peptides in the skin secretions detected by mass spectrometry. Natural mixtures of peptides and individual purified peptides strongly inhibit chytrid growth. The concentration of total peptides recovered from the skin of frogs following a mild norepinephrine induction is sufficient to inhibit chytrid growth in vitro. A comparison of the species susceptibility to chytridiomycosis and the antichytrid activity of peptides between *R. muscosa* and *R. pipiens* suggest that although *R. muscosa* produces more total skin peptides, it appears to be more vulnerable to *B. dendrobatidis* in nature. Possible differences in the antimicrobial peptide repertoires and life history traits of the two species that may account for differences in susceptibility are discussed.
Descriptors: mountain yellow-legged frog, *Rana muscosa*, amphibian proteins, *Batrachochytrium dendrobatidis*, pathogenic chytrid fungus, chytridiomycosis, dermatomycoses, decline of amphibian populations, antimicrobial peptides, disease susceptibility.

Rollins Smith, L.A., C. Carey, J. Longcore, J.K. Doersam, A. Boutte, J.E. Bruzgal, and J.M. Conlon (2002). **Activity of antimicrobial skin peptides from ranid frogs against *Batrachochytrium dendrobatidis* , the chytrid fungus associated with global amphibian declines.** *Developmental and Comparative Immunology* 26(5): 471-479. ISSN: 0145-305X.

Descriptors: amphibians, *Rana*, proteins, antimicrobial peptides, skin, fungal diseases, *Batrachochytrium dendrobatidis*, antimicrobial skin peptides effect on fungus, immune response.

Rose, G.J. and D.M. Gooler (2007). **Function of the amphibian central auditory system**. In: *Springer Handbook of Auditory Research.* Vol. 28, 250-290, Springer: New York, NYISBN: 0387325212.
Descriptors: amphibians, central auditory system, function, hearing, sensory system, book chapter.

Ruchin, A.B. (2003). **Effects of permanent and variable illumination on development of the clawed frog *Xenopus laevis* larvae.** *Zoologicheskii Zhurnal* 82(7): 834-838. ISSN: 0044-5134.
Descriptors: amphibians, clawed frog, *Xenopus laevis*, development, illumination, permanent, varaiable, effects, larvae.
Language of Text: Russian.

Ruchin, A.B. (2002). **Effects of monochromatic light on growth and development of the clawed frog *Xenopus laevis* larvae.** *Zoologicheskii Zhurnal* 81(6): 752-756. ISSN: 0044-5134.
Descriptors: clawed frog, *Xenopus laevis*, growth, development, effects of monochromatic light, larvae, tadpoles.
Language of Text: Russian.

Ruzov, A., D.S. Dunican, A. Prokhortchouk, S. Pennings, I. Stancheva, E. Prokhortchouk, and R.R. Meehan (2004). **Kaiso is a genome-wide repressor of transcription that is essential for amphibian development.** *Development* 131(24): 6185-6194. ISSN: print: 0950-1991; online: 1477-9129.
Abstract: DNA methylation in animals is thought to repress transcription via methyl-CpG specific binding proteins, which recruit enzymatic machinery promoting the formation of inactive chromatin at targeted loci. Loss of DNA methylation can result in the activation of normally silent genes during mouse and amphibian development. Paradoxically, global changes in gene expression have not been observed in mice that are null for the methyl-CpG specific repressors MeCP2, MBD1 or MBD2. Here, we demonstrate that xKaiso, a novel methyl-CpG specific repressor protein, is required to maintain transcription silencing during early *Xenopus laevis* development. In the absence of xKaiso function, premature zygotic gene expression occurs before the mid-blastula transition (MBT). Subsequent phenotypes (developmental arrest and apoptosis) strongly resemble those observed for hypomethylated embryos. Injection of wild-type human kaiso mRNA can rescue the phenotype and associated gene expression changes of xKaiso-depleted embryos. Our results, including gene expression profiling, are consistent with an essential role for xKaiso as a global repressor of methylated genes during early vertebrate development.
Descriptors: amphibians, development, Kaiso, genome, repressor, transcription, DNA methylation, methylated genes, develpmental arrest.

Sato, T., Y. Okada, T. Miyazaki, Y. Kato, and K. Toda (2005). **Taste cell responses in the frog are modulated by parasympathetic efferent nerve fibers.** *Chemical Senses* 30(9): 761-769. ISSN: 0379-864X.
Descriptors: frog, *Rana catesbeiana*, parasympathetic efferent nerve fibres, taste cell responses, modulation by parasympathetic efferent nerve fibres.

Saxena, S., K. Singhal, and Suman (2003). **Effect of testosterone on the sex-differentiation in toad *Bufo andersonii*.** *Journal of Advanced Zoology* 24(1-2): 21-26. ISSN: 0253-7214.
Descriptors: toad, *Bufo andersonii*, testosterone, effect, sex determination, sex differentiation, effects of testosterone.

Schlosser, G. (2002). **Development and evolution of lateral line placodes in amphibians. II. Evolutionary diversification.** *Zoology [Jena]* 105(3): 177-193. ISSN: 0944-2006.
NAL Call Number: QL1.Z769
Descriptors: amphibians, lateral line, development, evolution, placodes, diversification.

Schnizler, M., A. Berk, M. Fronius, and W.G. Clauss (2002). **The amphibian lung provides a physiologically intact model for investigation of alveolar ion transport regulation**. *Pfluegers Archiv European Journal of Physiology* 443(Suppl. 1): S386. ISSN: 0031-6768.
Descriptors: amphibian, lung, physiologicall intact model, alveolar ion transport, regulation, respiratory system.

Segev, R., J. Puchalla, and M.J.2. Berry (2006). **Functional organization of ganglion cells in the salamander retina.** *Journal of Neurophysiology* 95(4): 2277-2292. ISSN: 0022-3077.
Abstract: Recently, we reported a novel technique for recording all of the ganglion cells in a retinal patch and showed that their receptive fields cover visual space roughly 60 times over in the tiger salamander. Here, we carry this analysis further and divide the population of ganglion cells into functional classes using quantitative clustering algorithms that combine several response characteristics. Using only the receptive field to classify ganglion cells revealed six cell types, in agreement with anatomical studies. Adding other response measures served to blur the distinctions between these cell types rather than resolve further classes. Only the biphasic off type had receptive fields that tiled the retina. Even when we attempted to split these classes more finely, ganglion cells with almost identical functional properties were found to have strongly overlapping spatial receptive fields. A territorial spatial organization, where ganglion cell receptive fields tend to avoid those of other cells of the same type, was only found for the biphasic off cell. We further studied the functional segregation of the ganglion cell population by computing the amount of visual information shared between pairs of cells under natural movie stimulation. This analysis revealed an extensive mixing of visual information among cells of different functional type. Together, our results indicate that the salamander retina uses a population code in which every point in visual space is represented by multiple neurons with subtly different visual sensitivities.
Descriptors: salamander, *Ambystoma* physiology, retina cytology, retina physiology, retinal ganglion cells physiology, action potentials physiology, algorithms, spatial behavior physiology, visual fields physiology.

Shalan, A.G., S.D. Bradshaw, P.C. Withers, G. Thompson, M.F.F. Bayomy, F.J. Bradshaw, and T. Stewart (2004). **Spermatogenesis and plasma testosterone levels in Western Australian burrowing desert frogs, *Cyclorana platycephala*, *Cyclorana maini*, and *Neobatrachus sutor*, during aestivation.** *General and Comparative Endocrinology* 136(1): 90-100. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: amphibians, western burrowing frogs, *Cyclorana maini*, *Cyclorana platycephala*, *Neobatrachus sutor*, spermatogenesis and plasma testosterone levels in burrowing desert frogs, during estivation.

Shane, M.A., C. Nofziger, and B.L. Blazer Yost (2006). **Hormonal regulation of the epithelial Na+ channel: from amphibians to mammals.** *General and Comparative Endocrinology* 147(1): 85-92. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Abstract: High-resistance epithelia derived from amphibian sources such as frog skin, toad urinary bladder, and the A6 *Xenopus laevis* kidney cell line have been widely used to elucidate the underlying mechanisms involved in the regulation of vectorial ion transport. More recently, the isolation of high-resistance mammalian cell lines has provided model systems in which to study differences and similarities between the regulation of ion transporter function in amphibian and mammalian renal epithelia. In the present study, we have compared the natriferic (Na+ retaining) responses to aldosterone, insulin, and vasotocin/vasopressin in the A6 and mpkCCDcl4 (mouse principal cells of the kidney cortical collecting duct) cell lines. The functional responses of the epithelial Na+ channel (ENaC) to hormonal stimulation were remarkably similar in both the amphibian and mammalian lines. In addition, insulin- and aldosterone-stimulated, reabsorptive Na+ transport in both cell lines requires the presence of functional PI3-kinase.
Descriptors: frog, toad, *Xenopus laevis*, aldosterone pharmacology, amphibia metabolism, insulin pharmacology, kidney drug effects, sodium channels metabolism, amiloride antagonists and inhibitors, amiloride pharmacology, cell line, chromones antagonists and inhibitors, chromones pharmacology, dogs, epithelial sodium channel, ion transport physiology, kidney metabolism, mice, morpholines antagonists and inhibitors, morpholines pharmacology, vasotocin.

Shimizu, S. and H. Ota (2003). **Normal development of *Microhyla ornata*: the first description of the complete embryonic and larval stages for the microhylid frogs (Amphibia: Anura).** *Current Herpetology* 22(2): 73-90. ISSN: 1345-5834.
Descriptors: microhylid frogs, *Microhyla ornata*, normal development, embryonic, larval, stages, first description.

Simmons, D.D., S.W.F. Meenderink and P.N. Vassilakis (2007). **Anatomy, physiology, and function of auditory end-organs in the frog inner ear**. In: *Springer Handbook of Auditory Research.* Vol. 28, Springer: New York, NY, p. 184-220. ISBN: 0387325212.
Descriptors: amphibians, frog, auditory end organs, inner ear, functions, anatomy, physiology, book chapter.

Simon, H.G. (2002). **Messenger RNA differntial [differential] display strategies in birds and amphibians.** *CMLS Cellular and Molecular Life Sciences* 59(8): 1264-1273. ISSN: 1420-682X.
Descriptors: amphibians, birds, messenger RNA, display strategies, differential, genes, expression levels.

Simon, M.P. and K.E. Mccarson (2002). **Nociceptive sensitivity of the frog *rana pipiens* to vanilloids.** In: *32nd Annual Meeting of the Society for Neuroscience, Society for Neuroscience Abstract Viewer and Itinerary Planner.,November 2, 2002-November 7, 2002, Orlando, Florida, USA,* Vol. 2002, p. Abstract No. 49.13.
Online: http://sfn.scholarone.com
Descriptors: amphibians, frog, *Rana pipiens*, nociceptive sensitivity, vanilloids, noxious stimuli, vertebrates, conference proceedings.

Skoblina, M.N. (2002). **The role of chloride channels and chloride ions in regulation of steroidogenesis in the gonads, of amphibians, birds, and mammals.** *Ontogenez* 33(4): 292-302. ISSN: 0475-1450.
Descriptors: amphibians, aves, mammals, literature review, gonadal steroidogenesis, ion and water relations, chloride channels, steroids, hormones, gonads, effects, review.
Language of Text: Russian; Summary in English and Russian.

Smirnov, S.V. (2006). **Metamorphosis in the urodelan amphibians: patterns, regulation mechanisms, and evolution**. *Zhurnal Obshchei Biologii* 67(5): 323-334. ISSN: 0044-4596.
Descriptors: amphibians, salamanders, metamorphosis, urodelan evolution, regulation of metamorphosis, patterns.
Language of Text: Russian.

Smirnov, S.V. and A.B. Vassilieva (2002). **Skeletal and dental ontogeny in the long-tailed clawed salamander, *Onychodactylus fischeri* (Urodela: Hynobiidae).** *Russian Journal of Herpetology* 9(1): 21-32. ISSN: 1026-2296.
Descriptors: amphibians, salamander, *Onychodactylus fischeri*, skeleton, morphology, ontogeny, dentition, skull, development.

Song, M.O., D.J. Fort, D.L. Mclaughlin, R.L. Rogers, J.H. Thomas, B.O. Buzzard, A.M. Noll, and N.K. Myers (2003). **Evaluation of *Xenopus tropicalis* as an alternative test organism for frog embryo teratogenesis assay: Xenopus (fetax).** *Drug and Chemical Toxicology* 26(3): 177-189. ISSN: print: 0148-0545; online: 1525-6014.
NAL Call Number: QP901.D7
Descriptors: amphibians, *Xenopus tropicalis*, frog embryo, teratogenesis assay, test organism, alternative, evaluation, ICCVAM.

Srivastava, U.C. and S. Srivastava (2002). **Ventral root projections in the spinal cord in frog *R. tigrina*.** *Proceedings of the National Academy of Sciences India Section B Biological Sciences* 72(2): 169-172. ISSN: 0369-8211.

NAL Call Number: Q73.N311
Descriptors: frog, *Rana tigrina*, spinal cord, ventral root projections.

Stevens, C.W. and C.M. Brasel (2003). **Amphibian opioid receptors: cloning and sequence suggests pattern of opioid receptor evolution.** *Society for Neuroscience Abstract Viewer and Itinerary Planner* 2003: Abstract No. 577.10. ISSN: 0190-5295.
Online: http://sfn.scholarone.com
Descriptors: amphibians, opioid receptors, cloning, sequence, evolution, opioid analgesia, kappa receptors, delta receptors, mu, evolution.
Notes: Meeting Information: 33rd Annual Meeting of the Society of Neuroscience, New Orleans, LA, USA; November 8-12, 2003.

Stevens, C.W., G. Toth, A. Borsodi, and S. Benyhe (2007). **Xendorphin B1, a novel opioid-like peptide determined from a *Xenopus laevis* brain cDNA library, produces opioid antinociception after spinal administration in amphibians.** *Brain Research Bulletin* 71(6): 628-632. ISSN: 0361-9230.
Abstract: Prodynorphins (PDYNs) from the African clawed frog (*Xenopus laevis*), originally described as 'proxendorphins', are novel members of the family of opioid-like precursor polypeptides and were recently discovered based on polymerase chain reaction (PCR) isolates from a Xenopus brain cDNA library. This amphibian prodynorphin was found in two isoforms, (Xen)PDYN-A and (Xen)PDYN-B, consisting of 247 and 279 amino acids, respectively. Each prepropeptide contains five potential opioid-like peptides, collectively named xendorphins. One of these, xendorphin B1 ((Xen)PDYN-B sequence 96-111: YGGFIRK-PDKYKFLNA), is a hexadecapeptide that displaced [3H]naloxone and the radiolabelled kappa opioid, [3H]dynorphin A (1-17), with nanomolar affinity from rat brain membranes. Using the acetic acid pain test, the present study examined the antinociceptive effects of spinally administered xendorphin B1 in amphibians. Xendorphin B1 produced a long-lasting and dose-dependent antinociceptive effect in the Northern grass frog (*Rana pipiens*) with an ED50 value of 44.5 nmol/frog. The antinociceptive effects of xendorphin B1 were significantly blocked by pretreatment with the non-selective opioid antagonist, naltrexone. This is the first report of the in vivo characterization of a non-mammalian prodynorphin-derived peptide and suggests that xendorphin peptides may play a role in the modulation of noxious information in vertebrates.
Descriptors: amphibians, African clawed frog, *Xenopus laevis*, Northern grass frog, *Rana pipiens*, xendorphin B1, opioid like peptide, brain, opioid antinociception, spinal administration, polymerase chain reaction.

Stewart, E.R., S.A. Reese, and G.R. Ultsch (2004). **The physiology of hibernation in Canadian leopard frogs (*Rana pipiens*) and bullfrogs (*Rana catesbeiana*).** *Physiological and Biochemical Zoology* 77(1): 65-73. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Descriptors: leopard frog, *Rana pipiens*, bullfrog, *Rana catesbeiana*, hibernation, physiology.

Stiffler, D.F. (2005). **Endocrine control of water and electrolyte balance in amphibians.** In: H. Heatwhole (Editor), *Amphibian Biology. Vol. 6 - Endocrinology,* p. 2301-2326. ISBN: 0949324957.
Descriptors: amphibians, water and electrolyte balance, endocrine control.

Straka, H. and E. Gilland (2002). **Anatomical and functional organization of the vestibular commissure in frogs.** *Society for Neuroscience Abstract Viewer and Itinerary Planner.* 2002: Abstract No. 564.19. ISSN: 0190-5295.
Online: http://sfn.scholarone.com
Descriptors: amphibians, frogs, vestibular commissure, anatomy, brainstem, vestibular neurons.
Notes: Meeting Information: 32nd Annual Meeting of the Society for Neuroscience, Orlando, FL, USA; November 2-7, 2002.

Straka, H., R. Baker, and E. Gilland (2002). **The frog as a unique vertebrate model for studying the rhombomeric organization of functionally identified hindbrain neurons**. *Brain Research Bulletin* 57(3-4): 301-305. ISSN: 0361-9230.
Descriptors: frog, vertebrate model, hindbrain neurons, rhombomeric organization, studying , cranial nerve, precerebral neurons.

Suwalsky, M., S. Mennickent, B. Norris, and H. Cardenas (2006). **The antiepileptic drug phenytoin affects sodium transport in toad epithelium.** *Comparative Biochemistry and Physiology. Part C Toxicology and Pharmacology* 142(3-4): 253-261. ISSN: 1532-0456.
Abstract: The effects of phenytoin on isolated *Pleurodema thaul* toad skin were investigated. Low (micromolar) concentrations of the antiepileptic agent applied to the outside surface of the toad epithelium increased the electrical parameters (short-circuit current and potential difference) by over 40%, reflecting stimulation of Na(+) transport, whereas higher (millimolar concentrations, outside and inside surface) decreased both electric parameters, the effect being greater at the inside surface (40% and 80% decrease, respectively). The amiloride test showed that the stimulatory effect was accompanied by an increase and the inhibitory effect by a decrease in the sodium electromotive force (ENa). It is concluded that the drug interaction with membrane lipid bilayers might result in a distortion of the lipid-protein interface contributing to disturbance of Na(+) epithelial channel activity. After applying the Na(+)-K(+)-ATPase blocker ouabain and replacing the Na(+) ions in the outer Ringer's solution by choline, it was concluded that both active and passive transport are involved in sodium absorption, although active transport predominates.
Descriptors: toad, *Pleurodema thaul*, anticonvulsants pharmacology, bufonidae physiology, epithelium drug effects, phenytoin pharmacology, sodium metabolism, choline pharmacology, electrophysiology, enzyme inhibitors pharmacology, epithelium metabolism, epithelium physiology, ion transport drug effects, Na+ K+ exchanging atpase antagonists and inhibitors, ouabain pharmacology.

Suwalsky, M., S. Mennickent, B. Norris, and H. Cardenas (2006). **The antiepileptic drug carbamazepine affects sodium transport in toad epithelium.** *Toxicology in Vitro* 20(6): 891-898. ISSN: 0887-2333.

Abstract: The present work investigates the effects of the antiepileptic drug carbamazepine (CBZ) on sodium transport in the isolated skin of the toad *Pleurodema thaul*. A submaximal concentration of the drug (0.2 mM) applied to the outer surface of the epithelium increased the electrical parameters short-circuit current (Isc) and potential difference (PD) by over 28%, whereas only a higher concentration (1 mM) induced over a 45% decrease in these parameters when applied to the inner surface. The amiloride test showed that the outer surface stimulatory effect was accompanied by an increase and the inner surface inhibitory effect by a decrease in the sodium electromotive force (ENa). Exploration of these effects of CBZ on the outer surface showed that 0.2 mM increased net Na+ (22Na) influx by 20% and 0.6 mM CBZ decreased Na+ mucosa-serosa flux by 19%, a result in agreement with the finding that higher concentrations of CBZ applied to the inner surface not only decreased ENa but also sodium conductance (GNa).

Descriptors: toad, *Pleurodema thaul*, anticonvulsants toxicity, carbamazepine toxicity, sodium metabolism, amiloride pharmacology, bufonidae, dose response relationship, drug, ion transport drug effects, skin drug effects, skin metabolism.

Suwalsky, M., C. Schneider, B. Norris, F. Villena, H. Cardenas, F. Cuevas, and C.P. Sotomayor (2002). **The local anesthetic proparacaine modifies sodium transport in toad skin and perturbs the structures of model and cell membranes.** *Zeitschrift Fur Naturforschung. C, Journal of Biosciences* 57(9-10): 930-938. ISSN: 0939-5075.

NAL Call Number: QH301.Z4

Descriptors: amphibians, toad, local anesthetic, proparacaine, sodium transport, modifies, toad skin, pertubes structures, cell membranes.

Szigeti, Z.M., C. Matesz, G. Szekely, S. Felszeghy, T. Bacskai, G. Halasi, Z. Meszar, and L. Modis (2006). **Distribution of hyaluronan in the central nervous system of the frog.** *Journal of Comparative Neurology* 496(6): 819-831. ISSN: 0021-9967.

Descriptors: frog, *Rana esculenta*, hyaluronan, distribution, central nervous system.

Takahashi, Y. and S. Yokoyama (2005). **Genetic basis of spectral tuning in the violet-sensitive visual pigment of African clawed frog, *Xenopus laevis*.** *Genetics* 171(3): 1153-1160. ISSN: 0016-6731.

Descriptors: African clawed frog, *Xenopus laevis*, visual pigments, violet sensitive visual pigment, genetic basis of spectral tuning.

Tan, W.G.H., T.J. Barkman, V.G. Chinchar, and K. Essani (2004). **Comparative genomic analyses of frog virus 3, type species of the genus Ranavirus (family Iridoviridae)**. *Virology* 323(1): 70-84. ISSN: 0042-6822.

Descriptors: amphibians, frog virus 3, comparative genomic analyses, Ranavirus, nucleotide sequence, FV3genome.

Tata, J.R. (2006). **Amphibian metamorphosis as a model for the developmental actions of thyroid hormone.** *Molecular and Cellular Endocrinology* 246(1-2): 10-20. ISSN: 0303-7207.

Abstract: Thyroid hormone (TH) elicits multiple physiological actions in vertebrates from fish to man. These actions can be divided into two broad categories: those where the hormone regulates developmental processes and those that involve actions in the adult organism. Amphibian metamorphosis is a most dramatic example of extensive morphological, biochemical and cellular changes occurring during post-embryonic development, which is obligatorily initiated and sustained by TH. It is, therefore, an ideal model system to understand the action of the hormone. Each tissue of the frog tadpole responds differently to TH, ranging from altered gene expression, morphogenesis, tissue re-structuring and extensive cell death, according to a developmental programme set in place before the thyroid gland begins to secrete the hormone. The key element determining the response to the hormone is the nuclear thyroid hormone receptor (TR). As in most vertebrates, there are two thyroid hormone receptors, TRalpha and TRbeta, which repress transcription in the absence of the ligand and whose concentration in the tissues is directly modulated by the hormone itself. In Xenopus, biochemical and in situ techniques have shown that the amount of TRbeta mRNA and protein are elevated 50-100 times during TH-induced metamorphic climax. This phenomenon of "autoinduction" of receptor is also seen with developmental or inductive processes regulated by other hormones acting through nuclear receptors. It is possible that receptor upregulation may be a pre-requisite for hormonal response. Recent molecular and cell biological studies have suggested that TRs function as multimeric complexes with other nuclear or chromatin proteins, such as co-repressors and co-activators, to regulate the structure of the chromatin, and thereby determine the transcription of the receptor-specified target gene. There is evidence that this may also be so for thyroid hormone regulated transcription during amphibian metamorphosis.

Descriptors: amphibia growth and development, metamorphosis biological, models biological, thyroid hormones physiology, apoptosis, receptors, thyroid hormone genetics, receptors, thyroid hormone physiology.

Taylor, B.E., M.B. Harris, M.J. Gdovin, and J.C. Leiter (2002). **Central respiratory chemoreception during frog development: the role of carbonic anhydrase**. *FASEB Journal* 16(5): A813. ISSN: 0892-6638.

NAL Call Number: QH301.F3

Descriptors: amphibians, frog, *Rana catesbeiana*, chemoreception, development, central respiratory, carbomic anhydrase, role, tadpoles, meeting.

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

Tota, B. (2003). **Modulation of cardiac performance in teleosts and amphibians: nitric oxide-cgmp mechanisms.** *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 134A(Suppl. 1): S46-S47. ISSN: 1095-6433.

Descriptors: amphibians, cardiac performance, modulation, teleosts, nitric oxide-cgmp mechanisms, meeting.

Notes: Meeting Information: Sixth International Congress of Comparative Physiology and Biochemistry, Mt Buller, Australia; February 2-7, 2003.

Trapani, G., M. Franco, A. Trapani, A. Lopedota, A. Latrofa, E. Gallucci, S. Micelli, and G. Liso (2004). **Frog intestinal sac: a new in vitro method for the assessment of intestinal permeability.** *Journal of Pharmaceutical Sciences* 93(12): 2909-2919. ISSN: 0022-3549.
Descriptors: amphibians, frog intestinal sac, intestinal permeability, assessment, invitro method. new, drug permeability, humans.

Tsai, P.S., J.B. Lunden, and J.T. Jones (2003). **Effects of steroid hormones on spermatogenesis and GnRH release in male Leopard frogs, *Rana pipiens*.** *General and Comparative Endocrinology* 134(3): 330-338. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: leopard frogs, male, *Rana pipiens*, steroid hormones, effects, spermatogenesis and gnRH release.

Ukena, K., A. Koda, K. Yamamoto, E. Iwakoshi Ukena, H. Minakata, S. Kikuyama, and K. Tsutsui (2006). **Structures and diverse functions of frog growth hormone-releasing peptide (fgrp) and its related peptides (fgrp-rps): a review**. *Journal of Experimental Zoology* 305A(9): 815-821. ISSN: print: 1548-8969; online: 1552-499X.
NAL Call Number: 410 J825
Descriptors: amphibians, frog, growth hormone releasing peptide, structures, diverse functions, related peptides, review.

Ultsch, G.R., E.L. Brainerd, and D.C. Jackson (2004). **Lung collapse among aquatic reptiles and amphibians during long-term diving.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 139(1): 111-115. ISSN: 1095-6433.
Abstract: Numerous aquatic reptiles and amphibians that typically breathe both air and water can remain fully aerobic in normoxic (aerated) water by taking up oxygen from the water via extrapulmonary avenues. Nevertheless, if air access is available, these animals do breathe air, however infrequently. We suggest that such air breathing does not serve an immediate gas exchange function under these conditions, nor is it necessarily related to buoyancy requirements, but serves to keep lungs inflated that would otherwise collapse during prolonged submergence. We also suggest that lung deflation is routine in hibernating aquatic reptiles and amphibians in the northern portions of their ranges, where ice cover prevents surfacing for extended periods.
Descriptors: amphibians, lung collapse, long term diving, aquatic reptiles, air breathing, water breathing, gas exchange function, northern ranges, hibernation.

Usher Smith, J.A., J.A. Fraser, P.S. Bailey, J.L. Griffin, and C.L. Huang (2006). **The influence of intracellular lactate and H+ on cell volume in amphibian skeletal muscle.** *Journal of Physiology* 573(3): 799-818. ISSN: print: 0022-3751; online: 1469-7793 .
Online: http://dx.doi.org/10.1113/jphysiol.2006.108316
NAL Call Number: 447.8 J82

Abstract: The combined effects of intracellular lactate and proton accumulation on cell volume, Vc, were investigated in resting *Rana temporaria* striated muscle fibres. Intracellular lactate and H+ concentrations were simultaneously increased by exposing resting muscle fibres to extracellular solutions that contained 20-80 mm sodium lactate. Cellular H+ and lactate entry was confirmed using pH-sensitive electrodes and 1H-NMR, respectively, and effects on Vc were measured using confocal microscope xz-scanning. Exposure to extracellular lactate up to 80 mm produced significant changes in pH and intracellular lactate (from a pH of 7.24 +/- 0.03, n = 8, and 4.65 +/- 1.07 mm, n = 6, respectively, in control fibres, to 6.59 +/- 0.03, n = 4, and 26.41 +/- 0.92 mm, n = 3, respectively) that were comparable to those observed following fatiguing stimulation (6.30-6.70 and 18.04 +/- 1.78 mm, n = 6, respectively). Yet, the increase in intracellular osmolarity expected from such an increase in intracellular lactate did not significantly alter Vc. Simulation of these experimental results, modified from the charge difference model of Fraser & Huang, demonstrated that such experimental manoeuvres produced changes in intracellular [H+] and [lactate] comparable to those observed during muscle fatigue, and accounted for this paradoxical conservation of Vc through balancing negative osmotic effects resulting from the net cation efflux that would follow a titration of intracellular membrane-impermeant anions by the intracellular accumulation of protons. It demonstrated that with established physiological values for intracellular buffering capacity and the permeability ratio of lactic acid and anionic lactate, P(LacH): P(Lac-), this would provide a mechanism that precisely balanced any effect on cell volume resulting from lactate accumulation during exercise.
Descriptors: amphibians, *Rana temporaria*, cell size, intracellular fluid, muscle fibers cytology, sodium lactate metabolism, skeletal muscle.

Uteshev, V. and E. Gakhova (2005). **Gene cryobanks for conservation of endangered amphibian species.** *Russian Journal of Herpetology* 12: 233-234 (Suppl.) ISSN: 1026-2296.
Descriptors: amphibians, conservation, gene cryobanks, endangered species, genetic techniques.

Uteshev, V.K., T.N. Pashovkin, A.N. Sevirov, E.V. Mel'nikova, D.G. Sadikova, V.N. Karnaukhov, and E.N. Gakhova (2006). **[Survival of amphibian embryos after continuous ultrasound treatment]**. *Biofizika* 51(3): 539-544. ISSN: 0006-3029.
Abstract: The influence of continuous ultrasound on the embryonic development of grass frog *Rana temporaria* has been investigated. Intact embryos at the blastula stage were treated by ultrasound of different frequency (0.88 and 2.64 MHz), intensity (0.05-1.0 W/cm2), and duration (1-15 min). The treatment with ultrasound of frequency 0.88 MHz and intensity 0.05 W/cm2 for 1-5 min tended to increase the proportion of normally developing embryos up to hatch (10-25% of control). Increasing the intensity of ultrasound (0.88 MHz) to 0.7-1.0 W/cm2 and the duration of its action to 5-15 min induced the death of almost all of treated embryos. No significant differences were found between the development of control embryos and embryos treated with ultrasound of middle intensity (0.2-0.7 W/cm2) for 1-5 min. The exposure of amphibian embryos to ultrasound of frequency 2.64 MHz and intensity 0.05-0.7 W/cm2 for 1-5 min did not change their survival. Increasing the intensity of ultrasound (2.64 MHz) to 1.0 W/cm2 and the duration of its action to 5 min decreased the

number of normal developing embryos (by 35%).
Descriptors: *Rana temporaria* embryology, ultrasonics adverse effects, blastula physiology, embryo, nonmammalian physiology, embryonic development, time factors.
Language of Text: Russian.

Vasilakos, K., N. Kimura, R.J.A. Wilson, and J.E. Remmers (2006). **Lung and buccal ventilation in the frog: uncoupling coupled oscillators**. *Physiological and Biochemical Zoology* 79(6): 1010-1018. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Descriptors: amphibians, frog, lung, buccal, ventilation, uncoupling, coupled oscillators, model, respiratory rhythm, opioid, inhibits.

Vega, R., A. Ortega, A. Almanza, and E. Soto (2006). **Nitric oxide in the amphibian (*Ambystoma tigrinum*) lateral line.** *Neuroscience Letters* 393(1): 65-69. ISSN: 0304-3940.
Descriptors: amphibian, *Ambystoma tigrinum*, lateral line, nitric oxide.

Venturino, A., E. Rosenbaum, A. Caballero de Castro, O.L. Anguiano, L. Gauna, T. Fonovich de Schroeder, and A.M. Pechen de d'Angelo (2003). **Biomarkers of effect in toads and frogs.** *Biomarkers* 8(3-4): 167-186. ISSN: 1354-750X.
Descriptors: toads, frogs, Bufo, biomarkers of effect.

Vitanova, L. (2006). **Immunocytochemical study of glycine receptors in the retina of the frog *Xenopus laevis*.** *Anatomy and Embryology* 211(3): 237-245. ISSN: 0340-2061.
Abstract: The expression of glycine receptors in the retina of clawed frog, *Xenopus laevis* was studied immunocytochemically. Glycine receptors (GlyRs), as revealed by means of several different antibodies, were mainly distributed in the inner (IPL) and the outer plexiform layers. Their composition was determined to include alpha2 and alpha3 subunits. Typical punctate appearance and specific lamination in the IPL were seen with each of the antibodies directed against the different GlyRs' subunits. A notion for diversity of the glycine receptors was put forward, according to which the alpha2 and alpha3 subunits are located in different subtypes of glycine synapses.
Descriptors: frog, *Xenopus laevis*, receptors, glycine metabolism, retina metabolism, immunohistochemistry, protein subunits biosynthesis , protein subunits chemistry, protein subunits metabolism, glycine biosynthesis, glycine chemistry, retina anatomy, histology, retina chemistry.

Weick, S.E., M.G. Knutson, B.C. Knights, and B.C. Pember (2005). **A comparison of internal and external radio transmitters with northern leopard frogs (*Rana pipiens*).** *Herpetological Review* 36(4): 415-421. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: leopard frogs, *Rana pipiens*, radio telemetry, internal and external radio transmitters, comparison, radio tracking.

Wilczynski, W. and H. Endepols (2007). **Central auditory pathways in anuran amphibians: the anatomical basis of hearing and sound communication**. In: *Springer Handbook of Auditory Research.* Vol. 28, Springer: New York, NY, p. 221-249. ISBN: 0387325212.
Descriptors: amphibians, hearing, sound communication, central auditory pathways, anatomical basis, book chapter.

Wilczynski, W., K.S. Lynch, and E.L. O'Bryant (2005). **Current research in amphibians: Studies integrating endocrinology, behavior, and neurobiology.** *Hormones and Behavior* 48(4): 440-450. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Descriptors: amphibians, current research, endocrinology, behavior, neurobiology.

Wright, M.L. (2002). **Melatonin, diel rhythms, and metamorphosis in anuran amphibians.** *General and Comparative Endocrinology* 126(3): 251-254. ISSN: 0016-6480.
NAL Call Number: 444.8 G28
Descriptors: amphibians, anuran tadpoles, hormones, melatonin, diel rhythms, metamorphosis relationships, metamorphosis, literature review.

Yanchurevich, O.V. and S.V. Emelianchic (2005). **Definition of age an amphibians by a method skeletochronology.** *Vyestsi Natsyyanal'Nai Akademii Navuk Byelarusi Syeryya Biyalahichnykh Navuk* 3: 113-117. ISSN: 1029-8940.
Descriptors: amphibians, definition of age, method, skeletochronology.
Language of Text: Russian; Summary in English.

Yang CuiJun (2006). **Freeze tolerant mechanism of amphibian and its research strategies**. *Journal of Economic Animal* 10(2): 121-124. ISSN: 1007-7448.
Online: http://jjdwxb.periodicals.net.cn
Descriptors: amphibians, freeze tolerant, mechanism, research strategies, temperature.
Language of Text: Chinese; Summary in English.

Yu, Z.L., Q. Qiu, Z.M. Xu, and J.X. Shen (2006). **Auditory response characteristics of the piebald odorous frog and their implications.** *Journal of Comparative Physiology. A, Neuroethology, Sensory, Neural, and Behavioral Physiology* 192(8): 801-806. ISSN: 0340-7594.
NAL Call Number: QP33.J68
Abstract: The piebald odorous frog (*Odorrana schmackeri*), the large odorous frog (*Odorrana livida*) and the concave-eared torrent frog (*Amolops tormotus*) are sympatric species living near the same torrent streams in the vicinity of Mt. Huangshan, China. A recent study demonstrated that *A. tormotus* can use sound signals involving ultrasonic components for communication in a noisy environment, and another sympatric species, *O. livida*, can also perceive ultrasonic sound. Here we report data on the hearing range of *O. schmackeri* by studying auditory evoked potentials and single-unit data from the torus semicircularis. This frog exhibits its two most sensitive peaks at 2 kHz and 3.5-4.0 kHz with thresholds <42 dB SPL, with an upper frequency limit of hearing at 8.5 kHz with threshold of 87 dB SPL. The upper limit is much lower than those of *O. livida* and *A. tormotus*, at 22 and 34 kHz, respec-

tively. It suggests that sympatric species may respond differently to similar environmental selection pressures sculpting auditory communication systems.
Descriptors: frogs, *Odorrana schmackeri*, *Odorrana livida*, *Amolops tormotus*, auditory perception, hearing physiology, acoustic stimulation, brain stem cytology, radiation, evoked potentials, noise, reaction time, vocalization, animal physiology, China.

Yue, X.J., Y.G. Zhang, and Z.J. Wang (2002). **The histology and histo-chemistry studies of the digestive tract of the toad in China, *Bufo gargariizans.*** *Journal of Southwest China Normal University Natural Science* 27(3): 383-389; No 120. ISSN: 1000-5471.
Descriptors: toad, *Bufo gargariizans*, biochemistry, digestive system, digestive tract, anatomy, histology and histochemistry.
Language of Text: Chinese; Summary in Chinese and English.

Zardoya, R., E. Malaga Trillo, M. Veith, and A. Meyer (2003). **Complete nucleotide sequence of the mitochondrial genome of a salamander, *Mertensiella luschani.*** *Gene* 317(1-2): 17-27. ISSN: 0378-1119.
Descriptors: salamander, *Mertensiella luschani*, mitochondrial genome, complete nucleotide sequence.

Zayas, J.G., D.W. O'Brien, S. Tai, J. Ding, L. Lim, and M. King (2004). **Adaptation of an amphibian mucociliary clearance model to evaluate early effects of tobacco smoke exposure.** *Respiratory Research* 5: 9. ISSN: 1465-9921.
Abstract: RATIONALE: Inhaled side-stream tobacco smoke brings in all of its harmful components impairing mechanisms that protect the airways and lungs. Chronic respiratory health consequences are a complex multi-step silent process. By the time clinical manifestations require medical attention, several structural and functional changes have already occurred. The respiratory system has to undergo an iterative process of injury, healing and remodeling with every exposure. METHODS: To have a better understanding of the initial changes that take place when first exposed to environmental tobacco smoke, we have developed an exposure model, using the frog palate that closely represents the features of obstructive airways where ciliary dysfunction and mucus hypersecretion occur. RESULTS: Mucus transport was significantly reduced, even after exposure to the smoke of one cigarette ($p < 0.05$) and even further with 4-cigarettes exposure ($p < 0.001$). Morphometric and ultrastructural studies by SEM show extensive areas of tissue disruption. Gelatinase zymography shows activation of MMP9 in mucus from palates exposed to tobacco smoke. CONCLUSIONS: The clearance of mucus on the frog palate is significantly reduced after exposure to environmental tobacco smoke. Cilia and the extracellular matrix are anatomically disrupted. Tobacco smoke triggers an increased activity of matrix metalloproteinases associated with a substantial defoliation of ciliated epithelium. These studies enhance the knowledge of the changes in the mucociliary apparatus that occur initially after exposure to environmental tobacco smoke, with the goal of understanding how these changes relate to the genesis of chronic airway pathologies in humans.
Descriptors: amphibians, frog, *Rana catesbeiana*, environmental exposure adverse effects,

tobacco smoke exposure, animal models, mucociliary clearance, palate pathology, anatomy, histology, palate drug effects.

Zhang, P., Y.Q. Chen, Y.F. Liu, H. Zhou, and L.H. Qu (2003). **The complete mitochondrial genome of the Chinese giant salamander, *Andrias davidianus* (Amphibia: Caudata).** *Gene* 311: 93-98. ISSN: 0378-1119.
Descriptors: Chinese giant salamander, *Andrias davidianus*, the complete mitochondrial genome, amphibians.

Zhang, P., Y.Q. Chen, H. Zhou, X.L. Wang, and L.H. Qu (2003). **The complete mitochondrial genome of a relic salamander, *Ranodon sibiricus* (Amphibia: Caudata) and implications for amphibian phylogeny.** *Molecular Phylogenetics and Evolution* 28(3): 620-626. ISSN: 1055-7903.
NAL Call Number: QH367.5.M56
Descriptors: relic salamander, *Ranodon sibiricus*, amphibian, complete mitochondrial genome , implications, amphibian phylogeny.

Zhang, P., H. Zhou, D. Liang, Y.F. Liu, Y.Q. Chen , and L.H. Qu (2005). **The complete mitochondrial genome of a tree frog, *Polypedates megacephalus* (Amphibia: Anura: Rhacophoridae), and a novel gene organization in living amphibians.** *Gene* 346: 133-143. ISSN: 0378-1119.
Descriptors: tree frog, *Polypedates megacephalus*, amphibians, Anura, mitochondrial genome, complete, gene organization.

Zhang, Y. (2006). **Amphibian skin secretions and bio-adaptive significance - implications from *Bombina maxima* skin secretion proteome.** *Zoological Research* 27(1): 101-112. ISSN: 0254-5853.
Online: http://www.bioline.org.br/abstract?id=zr06017&lang=en
NAL Call Number: QL1.T85
Descriptors: amphibians, *Bombina maxima*, skin secretions, bio-adaptive significance, skin secretion proteome, antimicrobial properties, study model.
Language of Text: Chinese; Summary in Chinese and English.

Stress and Well-being

Ankley, G.T., S.J. Degitz, S.A. Diamond, and J.E. Tietge (2004). **Assessment of environmental stressors potentially responsible for malformations in North American anuran amphibians.** *Ecotoxicology and Environmental Safety* 58(1): 7-16. ISSN: 0147-6513.
NAL Call Number: QH545.A1E29
Descriptors: anuran amphibians, environmental stressors, malformations, assessment, potentially responsible, chemical polution, North America.

Battaglin, W., L. Hay, G. McCabe, P. Nanjappa, and A. Gallant (2005). **Climate patterns as predictors of amphibian species richness and indicators of potential stress.** *Alytes Paris* 22(3-4): 146-167. ISSN: 0753-4973.
Descriptors: anuran, amphibians, urodela, species richness predictors, climate patterns, climate patterns as predictors of species richness, indicators of potential stress.
Language of Text: English; French.

Coddington, E. and F.L. Moore (2003). **Neuroendocrinology of context-dependent stress responses: vasotocin alters the effect of corticosterone on amphibian behaviors.** *Hormones and Behavior* 43(1): 222-228. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Descriptors: amphibian, stress responses, neuroendocrinology, vasotocin alters effect of corticosterone, behavior.

Crespi, E.J. and R.J. Denver (2005). **Roles of stress hormones in food intake regulation in anuran amphibians throughout the life cycle.** *Comparative Biochemistry and Physiology Part A Molecular and Integrative Physiology* 141(4): 381-390. ISSN: 1095-6433.
Descriptors: anuran amphibians, toad, stress hormones role, food intake regulation.

Gomez Mestre, I. and M. Tejedo (2003). **Local adaptation of an anuran amphibian to osmotically stressful environments.** *Evolution* 57(8): 1889-1899. ISSN: 0014-3820.
Descriptors: amphibian, anuran, osmotically stressful environments, salinity, brackish water, fresh water, adaptations.

Heikkila, J.J. (2004). **Regulation and function of small heat shock protein genes during amphibian development.** *Journal of Cellular Biochemistry* 93(4): 672-680. ISSN: 0730-2312.
Abstract: Small heat shock proteins (shsps) are molecular chaperones that are inducible by environmental stress such as elevated temperature or exposure to heavy metals or arsenate. Recent interest in shsps has been propelled by the finding that shsp synthesis or mutations are associated with various human diseases. While much is known about shsps in cultured cells, less is known about their expression and function during early animal development. In amphibian model systems, shsp genes are developmentally regulated under both normal and environmental stress conditions. For example, in *Xenopus*, the shsp gene family, hsp30, is

repressed and not heat-inducible until the late neurula/early tailbud stage whereas other hsps are inducible at the onset of zygotic genome activation at the midblastula stage. Furthermore, these shsp genes are preferentially induced in selected tissues. Recent studies suggest that the developmental regulation of these shsp genes is controlled, in part, at the level of chromatin structure. Some shsps including *Xenopus* and hsp30 are synthesized constitutively in selected tissues where they may function in the prevention of apoptosis. During environmental stress, amphibian multimeric shsps bind to denatured target protein, inhibittheir aggregation and maintain them in a folding-competent state until reactivated by other cellular chaperones. Phosphorylation of shsps appears to play a major role in the regulation of their function.
Descriptors: *Xenopus*, *Rana*, amphibian development, small heat shock protein genes, shsps, regulation, function, environmental stress, elevated temperature.

Homan, R.N., J.V. Regosin, D.M. Rodrigues, J.M. Reed, B.S. Windmiller, and L.M. Romero (2003). **Impacts of varying habitat quality on the physiological stress of spotted salamanders (*Ambystoma maculatum*).** *Animal Conservation* 6(1): 11-18. ISSN: 1367-9430.
NAL Call Number: QH75.A1 A54
Descriptors: spotted salamanders, *Ambystoma maculatum*, physiological stress, habitat quality, varying, impact.

Hosie, C. and N. Hind (2004). **Using behaviour to assess welfare in captive amphibians.** *Animal Welfare* 13(Suppl.): S244. ISSN: 0962-7286.
NAL Call Number: HV4701.A557
Descriptors: amphibians, captive, welfare, behavior, assess, meeting, UFAW.
Notes: Meeting Information: Universities Federation for Animal Welfare (UFAW) Symposium on Science in the Service of Animal Welfare, Edinburgh, UK; April 2-4, 2003.

Hurme, K., K. Gonzalez, M. Halvorsen, B. Foster, D. Moore, and B.D. Chepko Sade (2003). **Environmental enrichment for dendrobatid frogs.** *Journal of Applied Animal Welfare Science* 6(4): 285-299. ISSN: 1088-8705.
NAL Call Number: HV4701.J68
Descriptors: dendrobatid frogs, environmental enrichment, strategies, evaluation, care in captivity, behavior.

Kaminsky, S.K., T.U. Grafe, M. Spieler, and K.E. Linsenmair (2004). **A new method for immobilizing fossorial frogs after radiotransmitter implantation and notes on movement patterns of the pig-nosed frog, *Hemisus marmoratus*.** *Herpetological Review* 35(2): 146-148. ISSN: 0018-084X.
NAL Call Number: QL640.H47
Descriptors: pig nosed frog, *Hemisus marmoratus*, restraining techniques, immobilization, radiotransmitter implantation, movement patterns.

Kinkead, K.E., J.D. Lanham, and M.R. Montanucci (2006). **Comparison of anesthesia and marking techniques on stress and behavioral responses in two desmognathus salamanders**. *Journal of Herpetology* 40(3): 323-328. ISSN: 0022-1511.

NAL Call Number: QL640.J6
Descriptors: amphibians, salamanders, *Desmognathus fuscus*, *Desmognathus monticola*, dusky salamanders, seal salamanders, anesthesia, marking techniques, stress levels, behavioral responses, comparison, toe clipping, pain.

Konno, N., S. Hyodo, K. Matsuda, and M. Uchiyama (2006). **Effect of osmotic stress on expression of a putative facilitative urea transporter in the kidney and urinary bladder of the marine toad, *Bufo marinus***. *Journal of Experimental Biology* 209(7): 1207-1216. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.02123
NAL Call Number: 442.8 B77
Descriptors: amphibians, anuran, marine toad, *Bufo marinus*, osmotic stress, effect, kidney, urea transporter, urinary bladder.

Moore, I.T. and T.S. Jessop (2003). **Stress, reproduction, and adrenocortical modulation in amphibians and reptiles.** *Hormones and Behavior* 43(1): 39-47. ISSN: 0018-506X.
NAL Call Number: QP801.H7H64
Abstract: While the hypothalamo-pituitary-adrenocortical (HPA) response to stress appears to be conserved in vertebrates, the manner in which it is activated and its actions vary. We examine two trends in the stress biology literature that have been addressed in amphibian and reptilian species: (1). variable interactions among stress, corticosterone, and reproduction and (2). adrenocortical modulation. In the first topic we examine context-dependent interactions among stress, corticosterone, and reproduction. An increasing number of studies report positive associations between reproduction and corticosterone that contradict the generalization that stress inhibits reproduction. Moderately elevated levels of stress hormones appear to facilitate reproduction by mobilizing energy stores. In contrast, pronounced activation of the HPA axis and extremely elevated levels of stress hormones appear to inhibit reproduction. Much of these contrasting effects of stress and reproduction can be explained by expanding the Energetics-Hormone Vocalization Model, proposed for anuran calling behavior, to other taxa. In the second topic, a number of amphibians and reptiles modulate their HPA stress response. Adrenocortical modulation can occur at multiple levels and due to a variety of factors. However, we have little information as to the physiological basis for the variability. We suggest that several ecologically based ideas, such as variability in the length of the breeding season and lifetime reproductive opportunities, can be used to explain the utility of adrenocortical modulation in these taxa.
Descriptors: amphibians, reptiles, stress, reproduction, adrenocortical modulation, energy stores.

Neptune, D.E. and R.E. Deneault (2006). **Environmental enrichment for amphibians and reptiles: a report on the Reptile Enrichment Workshop held at the 2004 Annual Conference of the Australasian Society of Zoo Keeping (ASZK).** *Animal Keepers' Forum* 33(9): 374-384. ISSN: 0164-9531.
NAL Call Number: QL77.5.A54

Descriptors: amphibians, reptilians, enrichment, workshop, Australasian Society of Zoo Keeping, conference proceedings, care in captivity.

Parris, M.J. and T.O. Cornelius (2004). **Fungal pathogen causes competitive and developmental stress in larval amphibian communities.** *Ecology* 85(12): 3385-3395. ISSN: 0012-9658.
Descriptors: *Bufo*, *Hyla*, frogs, animal pathogenic fungi, mycoses, animal development, interspecific competition, mortality, *Bratrachochytrium dendrobatidis.*

Wilms, T., B. Kuegelgen, and T. Schreckenbach (2005). **Zur Haltung, Pflege und Vermehrung des Baumhoehlen-Kroetenlaubfrosches, *Trachycephalus resinifictrix* (Goeldi, 1907) im Reptilium Landau. [The husbandry, care and breeding of the bone-headed tree frog *Trachycephalus resinifictrix* (Goeldi, 1907) in the Landau reptile house.]**. *Draco* 6(3): 66-72 Nr 23. ISSN: 1439-8168.
Descriptors: bone headed tree frog, *Trachycephalus resinifictrix*, husbandry, care, breeding, Landau.
Language of Text: German.

Thermal and Temperature

Aggeli, I.K.S., C. Gaitanaki, A. Lazou, and I. Beis (2002). **Hyperosmotic and thermal stresses activate p38-MAPK in the perfused amphibian heart.** *Journal of Experimental Biology* 205(4): 443-454. ISSN: 0022-0949.
NAL Call Number: 442.8 B77
Descriptors: amphibians, *Rana ridibunda*, enzymes, p38 mapk activation, effects of thermal and osmotic stresses in perfused heart, functional implications, heart, salinity, temperature.

Ala Laurila, P., P. Saarinen, R. Albert, A. Koskelainen, and K. Donner (2002). **Temperature effects on spectral properties of red and green rods in toad retina.** *Visual Neuroscience* 19(6): 781-792. ISSN: 0952-5238.
Descriptors: amphibians, toad, eyes, retina, red rods, green rods, temperature effects, spectral properties.

Arendt, J. and L. Hoang (2005). **Effect of food level and rearing temperature on burst speed and muscle composition of western spadefoot toad (*Spea hammondii*).** *Functional Ecology* 19(6): 982-987. ISSN: 0269-8463.
NAL Call Number: QH540.F85
Descriptors: amphibians, western spadefoot toad, *Spea hammondii*, food level, rearing temperature, burst speed, muscle composition, effect.

Beebee, T.J.C. (2002). **Amphibian phenology and climate change.** *Conservation Biology* 16(6): 1454. ISSN: 0888-8892.
NAL Call Number: QH75.A1C5
Descriptors: amphibians, climate change, phenology, reproduction, breeding times.

Berger, L., R. Speare, H.B. Hines, G. Marantelli, A.D. Hyatt, K.R. McDonald, L.F. Skerratt, V. Olsen, J.M. Clarke, G. Gillespie, M. Mahony, N. Sheppard, C. Williams, and M.J. Tyler (2004). **Effect of season and temperature on mortality in amphibians due to chytridiomycosis.** *Australian Veterinary Journal* 82(7): 434-439. ISSN: 0005-0423.
NAL Call Number: 41.8 Au72
Descriptors: amphibians, anura, fungal diseases, chytridiomycosis, season and temperature, effects on mortality, season, temperature, Australia.

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.

Browne, R.K. and D.L. Edwards (2003). **The effect of temperature on the growth and development of the endangered green and golden bell frog (*Litoria aurea*).** *Journal of Thermal Biology* 28(4): 295-299. ISSN: 0306-4565.

NAL Call Number: QP82.2.T4J6

Descriptors: amphibians, green and golden bull frog, growth, development, temperature, effect, *Litoria aurea.*

Castaneda, L.E., P. Sabat, S.P. Gonzalez, and R.F. Nespolo (2006). **Digestive plasticity in tadpoles of the chilean giant frog (*Caudiverbera caudiverbera*): factorial effects of diet and temperature**. *Physiological and Biochemical Zoology* 79(5): 919-926. ISSN: 1522-2152.

NAL Call Number: QL1.P52

Descriptors: amphibians, giant frog, digestive plasticity, factorial effects, diet, temperature, *Caudiverbera caudiverbera.*

Chardard, D., M. Penrad Mobayed, A. Chesnel, C. Pieau and C. Dournon (2004). **Thermal sex reversals in amphibians.** In: N.L.V. Valenzuela (Editors), *Temperature-Dependent Sex Determination in Vertebrates.,* Smithsonian Books: Washington, DC, p. 59-67. ISBN: 1588342034.

NAL Call Number: QP278.5 .T45 2004

Descriptors: amphibians, temperature, sex determination, temperature dependent sex reversal.

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.

Corn, P.S. (2005). **Climate change and amphibians.** *Animal Biodiversity and Conservation* 28(1): 59-67. ISSN: 1578-665X.
Descriptors: amphibians, climate change, population declines, temperature, effect.
Language of Text: English; Spanish.

Costanzo, J.P. and R.E.J. Lee (2005). **Cryoprotection by urea in a terrestrially hibernating frog.** *Journal of Experimental Biology* 208(21): 4079-4089. ISSN: 0022-0949.
Online: http://dx.doi.org/10.1242/jeb.01859
NAL Call Number: 442.8 B77
Descriptors: frog, *Rana sylvatica*, hibernating, temperature, cold tolerance, urea, cryoprotection.

Currens, C.R., P.H. Niewiarowski, and H.H. Whiteman (2002). **Effects of temperature and time of day on the resting metabolic rates of paedomorphic and metamorphic mole salamanders, *Ambystoma talpoideum* .** *Copeia* 2002(2): 489-495. ISSN: 0045-8511.
Descriptors: salamander, *Ambystoma talpoideum*, oxygen consumption, resting metabolic rates, temperature and time of day, effects, paedomorphic vs metamorphic individuals, paedogenesis, metamorphosis, temperature.

Dalo, N.L., G.A. Bracho, and J.C. Pina Crespo (2007). **Motor impairment and neuronal damage following hypothermia in tropical amphibians.** *International Journal of Experimental Pathology* 88(1): 1-7. ISSN: print: 0959-9673; online: 1365-2613.
Abstract: Although the induction of mild to moderate cerebral hypothermia in mammals can have neuroprotective activity, some deleterious effects have been described when inducing deep hypothermia during cooling of the brain. In the spinal cord, rapid deep cooling can induce seizure activity accompanied by release of the excitatory neurotransmitters, glutamate and aspartate. We used cold-sensitive tropical amphibians as a model to determine (a) the critical temperature inside the central nervous system necessary to induce seizures during rapid cooling; (b) the survival rate during slow deep cooling of the whole animal; and (c) whether deep cooling can cause neuronal cell damage. Seizures induced by deep rapid (<or=3 min) cooling of the spinal cord began when a critical temperature of 10.4 degrees C was reached. During slow (>or=30 min) deep cooling of the whole animal (12 h at 2-3 degrees C), around 70% of animals died. Spinal reflexes were enhanced when temperatures within the spinal cord reached between 9.0 degrees C and 11.6 degrees C. A fivefold increase in blood glucose level was observed during slow deep cooling. Recovery after slow deep cooling was accompanied by motor impairment and the main histological findings were condensation of the cytoplasm and nuclear pyknosis. Severe neuronal cell damage was characterized by swelling, vacuolated cytoplasm with distended neuronal bodies. These results indicate that deep cooling can easily induce neuronal cell damage in the central nervous system of cold-sensitive animals. They also warn us to the potential sequels associated with the use of deep brain cooling as a neuroprotective strategy.
Descriptors: amphibians, hypothermia, motor impairment, neuronal damage, cold, cooling, brain, spinal cord, critical temperature, blood glucose.

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.

Finkler, M.S. (2006). **Effects of temperature, sex, and gravidity on the metabolism of small-mouthed salamanders, *Ambystoma texanum*, during the reproductive season**. *Journal of Herpetology* 40(1): 103-106. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: amphibians, small mouthed salamander, *Ambystoma texanum*, metabolism, temperature, sex, gravidity, effects, reproductive season.

Freidenburg, K. and D. Skelly (2003). **Microgeographic variation in thermal preference by an amphibian.** *Ecological Society of America Annual Meeting Abstracts* 88: 113. ISSN: 0012-9623.
Descriptors: amphibians, thermal preference, microgeographic variation, meeting.
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.

Garcia, T.S., R. Straus, and A. Sih (2003). **Temperature and ontogenetic effects on color change in the larval salamander species *Ambystoma barbouri* and *Ambystoma texanum.*** *Canadian Journal of Zoology* 81(4): 710-715. ISSN: 0008-4301.
NAL Call Number: 470 C16D
Descriptors: larval salamander species, *Ambystoma barbouri*, *Ambystoma texanum*, color change, temperature, ontogenetic effects, body color, amphibians.
Language of Text: English; French.

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.

Irwin, J.T., J.P. Costanzo, and R.E.J. Lee (2003). **Postfreeze reduction of locomotor endurance in the freeze-tolerant wood frog, *Rana sylvatica*.** *Physiological and Biochemical Zoology* 76(3): 331-338. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Descriptors: wood frog, *Rana sylvatica*, freeze tolerant, locomotor endurance, post freeze reduction, physiological adaptation.

Layne, J.R.J. and S.D. Kennedy (2002). **Cellular energetics of frozen wood frogs (*Rana sylvatica*) revealed via NMR spectroscopy.** *Journal of Thermal Biology* 27(3): 167-173. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: amphibians, frog, *Rana sylvatica*, ion and water relations, intracellular ph, temperature relationships, freeze tolerance, cellular energetics, nucleic acids, ATP and creative phosphate, temperature.

Layne, J.R.J. and M.E. Rice (2003). **Postfreeze locomotion performance in wood frogs (*Rana sylvatica*) and spring peepers (*Pseudacris crucifer*).** *Canadian Journal of Zoology* 81(12): 2061-2065. ISSN: 0008-4301.
NAL Call Number: 470 C16D
Descriptors: wood frogs, spring peepers, *Rana sylvatica*, *Pseudacris crucifer*, post freeze locomotion performance.
Language of Text: English; French.

Marvin, G.A. (2003). **Effects of acute temperature and thermal acclimation on aquatic and terrestrial locomotor performance of the three-lined salamander, *Eurycea guttolineata*.** *Journal of Thermal Biology* 28(3): 251-259. ISSN: 0306-4565.
NAL Call Number: QP82.2.T4J6
Descriptors: three lined salamander, *Eurycea guttolineata*, temperature, thermal acclimation, effects on aquatic and terrestrial locomotor performance.

Marvin, G.A. (2003). **Aquatic and terrestrial locomotor performance in a semiaquatic plethodontid salamander (*Pseudotriton ruber*): Influence of acute temperature, thermal acclimation, and body size.** *Copeia* 2003(4): 704-713. ISSN: 0045-8511.
Descriptors: plethodontid salamander, *Psuedotriton ruber*, aquatic and terrestrial locmotor performance, acute temperature, thermal acclimation, effect, body size.

Meek, R. and E. Jolley (2006). **Body temperatures of the common toad, *Bufo bufo* , in the Vendee, France.** *Herpetological Bulletin* 95: 21-24. ISSN: 1473-0928.
Descriptors: *Bufo bufo*, field body temperature, common toad , range, France.

Olsson, M. and T. Uller (2003). **Thermal environment, survival and local adaptation in the common frog, *Rana temporaria*.** *Evolutionary Ecology Research* 5(3): 431-437. ISSN: 1522-0613.
NAL Call Number: QH540.E96
Descriptors: common frog, *Rana temporaria*, thermal environment, survival, local adaptation.

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.

Raffel, T.R., J.R. Rohr, J.M. Kiesecker, and P.J. Hudson (2006). **Negative effects of changing temperature on amphibian immunity under field conditions**. *Functional Ecology* 20(5): 819-828. ISSN: 0269-8463.
NAL Call Number: QH540.F85
Descriptors: amphibians, immunity, changing temperature, negative effects, field conditions, seasonal acclimation, increased susceptibility.

Reading, C.J. (2003). **The effects of variation in climatic temperature (1980-2001) on breeding activity and tadpole stage duration in the common toad, *Bufo bufo*.** *Science of the Total Environment* 310(1-3): 231-236. ISSN: 0048-9697.
Descriptors: amphibians, toad, *Bufo bufo*, breeding activity, climatic temperature, variation, effects, tadpole stage duration.

Secor, S.M. and M. Boehm (2006). **Specific dynamic action of ambystomatid salamanders and the effects of meal size, meal type, and body temperature.** *Physiological and Biochemical Zoology* 79(4): 720-735. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Abstract: The past decade has witnessed a dramatic increase in studies of amphibian and reptile specific dynamic action (SDA). These studies have demonstrated that SDA, the summed energy expended on meal digestion and assimilation, is affected significantly by meal size, meal type, and body size and to some extent by body temperature. While much of this attention has been directed at anuran and reptile SDA, we investigated the effects of meal size, meal type, and body temperature on the postprandial metabolic responses and the SDA of the tiger salamander (*Ambystoma tigrinum tigrinum*). We also compared the SDA responses among six species of *Ambystoma* salamanders representing the breadth of Ambystoma phylogeny. Postprandial peaks in VO(2) and VO(2), duration of elevated metabolism, and SDA of tiger salamanders increased with the size of cricket meals (2.5%-12.5% of body mass). For A. tigrinum, as for other ectotherms, a doubling of meal size results in an approximate doubling of SDA, a function of equal increases in peak VO(2) and duration. For nine meal types of equivalent size (5% of body mass), the digestion of hard-bodied prey (crickets, superworms, mealworms, beetles) generated larger SDA responses than the digestion of soft-bodied prey (redworms, beetle larvae). Body temperature affected the profile of postprandial metabolism, increasing the peak and shortening the duration of the profile as body temperature increased. SDA was equivalent among three body temperatures (20 degrees, 25 degrees, and 30 degrees C) but decreased significantly at 15 degrees C. Comparatively, the postprandial metabolic responses and SDA of *Ambystoma jeffersonianum*, *Ambystoma maculatum*, *Ambystoma opacum*, *Ambystoma talpoideum*, *Ambystoma texanum*, and the conspecific *Ambystoma tigrinum mavortium* digesting cricket meals that were 5% of their body mass were similar (independent of body mass) to those of *A. t. tigrinum*. Among the six species, standard metabolic rate, peak postprandial VO(2), and SDA scaled with body mass with mass exponents of 0.72, 0.78, and 1.05, respectively.
Descriptors: ambystomatid salamander, *Ambystoma tigrinum tigrinum*, body temperature, feeding behavior physiology, food, Urodela physiology, Annelida, Cyprinidae, energy metabolism physiology, Gryllidae, mice, Tenebrio, time factors.

Secor, S.M. and A.C. Faulkner (2002). **Effects of meal size, meal type, body temperature, and body size on the specific dynamic action of the marine toad, *Bufo marinus*.** *Physiological and Biochemical Zoology* 75(6): 557-571. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Descriptors: amphibians, marine toad, *Bufo marinus*, size, body temperature, meal size, meal type, body size, effects.

Seebacher, F. and R.a. Alford (2002). **Shelter microhabitats determine body temperature and dehydration rates of a terrestrial amphibian (*Bufo marinus*)**. *Journal of Herpetology* 36(1): 69-75. ISSN: 0022-1511.
NAL Call Number: QL640.J6

Descriptors: amphibians, *Bufo marinus*, body temperature, dehydration rates, shelter microhabitats, *Bufo marinus*, toad, thermal conditions, seasonal changes.

Storey, K.B. and J.M. Storey (2004). **Physiology, biochemistry, and molecular biology of vertebrate freeze tolerance: The wood frog.** In: E.E.F.B.J.L.N. Benson (Editors), *Life in the Frozen State.,* CRC Press: Boca Raton, p. 243-274. ISBN: 0415247004.
NAL Call Number: QH324.9.C7 L545 2004
Descriptors: wood frog, vertebrate freeze tolerance, physiology, biochemistry, cryobiology.

Suominen, H., S. Nymark, K. Donner, and A. Koskelainen (2002). **Temperature effects on frog cone sensitivity.** *ARVO Annual Meeting Abstract Search and Program Planner* 2002: Abstract No. 1420. ISSN: print: 0146-0404; online: 1552-5783.
Descriptors: amphibians, frog, cone sensitivity, temperature effects, visual pigment , thermal activations, wavelength, meeting.
Notes: Meeting Information: Annual Meeting of the Association For Research in Vision and Ophthalmology, Fort Lauderdale, Florida, USA; May 5-10, 2002.

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.

Thibodeaux, L. and T.V. Hancock (2004). **The effects of developmental temperature on morphology and locomotor performance in the salamander, *Ambystoma maculatum*.** *FASEB Journal* 18(4-5): Abst. 238.9. ISSN: 0892-6638.
NAL Call Number: QH301.F3
Descriptors: amphibians, salamander, *Ambystoma maculatum*, developmental temperature, effects, morphology, locomotor performance, meeting.
Notes: Meeting Information: FASEB Meeting on Experimental Biology: Translating the Genome, Washington, District of Columbia, USA; April 17-21, 2004.

Vences, M., P. Galan, D.R. Vietes, M. Puente, K. Oetter, and S. Wanke (2002). **Field body temperatures and heating rates in a montane frog population: the importance of black dorsal pattern for thermoregulation.** *Annales Zoologici Fennici* 39(3): 209-220. ISSN: 0003-455X.
NAL Call Number: 410 AN712
Descriptors: montane frog, *Rana temporaria*, thermoregulation, field bodsy temperatures, heating rates, black dorsal pattern, montane frog population.

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., M. Eugene, and H. Barre (2003). **Survival and metabolic responses to freezing by the water frog (*Rana ridibunda*).** *Journal of Experimental Zoology* 299A(2): 118-126. ISSN: print: 0022-104X; online: 1097-010X.
NAL Call Number: 410 J825
Descriptors: water frog, *Rana ridibunda*, temperature, freezing, survival and metabolic responses.

Wang, L.z. and X.c. Li (2006). **Effect of temperature on egg incubation of the common giant toad.** *Hebei Nongye Daxue Xuebao* 29(3): 71-74 Sum No 126. ISSN: 1000-1573.
Descriptors: common giant toad, *Rana chensinensis*, egg incubation, effect of temperature.
Language of Text: Chinese; Summary in Chinese and English.

Wang, L.Z., X.C. Li, and T. Sun (2005). **Preferred temperature, avoidance temperature and lethal temperature of tadpoles of the common giant toad (*Bufo gargarizans*) and the Chinese forest frog (*Rana chensinensis*).** *Chinese Journal of Zoology* 40(2): 23-27. ISSN: 0250-3263.

Descriptors: tadpoles, *Bufo gargarizans*, frog, *Rana chensinensis*, preferred temperature, temperature avoidance, lethal temperature, effects, larvae.
Language of Text: Chinese; Summary in Chinese and English.

Watkins, T.B. and J. Vraspir (2006). **Both incubation temperature and posthatching temperature affect swimming performance and morphology of wood frog tadpoles (*Rana sylvatica*).** *Physiological and Biochemical Zoology* 79(1): 140-149. ISSN: 1522-2152.
NAL Call Number: QL1.P52
Descriptors: wood frog, tadpoles, *Rana sylvatica*, temperature, affect, morphology, swimming performance, incubation, post hatching, environmental temperatures, effects, larvae.

Whiteman, H.H. and N.L. Buschhaus (2003). **Behavioral thermoregulation in field populations of amphibian larvae.** In: *Exploring Animal Behavior in Laboratory and Field: An Hypothesis-Testing Approach to the Development, Causation, Function, and Evolution of Animal Behavior.* Academic Press Inc.: London, UK, San Diego, CA, p. 79-84. ISBN: 0125583303.
Descriptors: amphibians, larvae, behavioral thermoregulation, field populations, book chapter.

Woodhams, D.C., R.A. Alford, and G. Marantelli (2003). **Emerging disease of amphibians cured by elevated body temperature.** *Diseases of Aquatic Organisms* 55(1): 65-67. ISSN: 0177-5103.
Online: http://dx.doi.org/10.3354/dao055065
Descriptors: amphibians, emerging diseases, cured, elevated body temperature.

Yang, C.j. and X.h. Xiao (2006). **Study progress in freeze tolerant mechanism of amphibian.** *Sichuan Journal of Zoology* 25(2): 430-432. ISSN: 1000-7083.
Descriptors: amphibians, temperature, cold tolerance, freeze tolerance, mechanism, review.
Language of Text: Chinese; Summary in Chinese and English.

Yang CuiJun (2006). **Freeze tolerant mechanism of amphibian and its research strategies**. *Journal of Economic Animal* 10(2): 121-124. ISSN: 1007-7448.
Online: http://jjdwxb.periodicals.net.cn
Descriptors: amphibians, freeze tolerant, mechanism, research strategies, temperature.
Language of Text: Chinese; Summary in English.

Toxicity

Boone, M.D., R.D. Semlitsch, J.F. Fairchild, and B.B. Rothermel (2004). **Effects of an insecticide on amphibians in large-scale experimental ponds.** *Ecological Applications* 14(3): 685-691. ISSN: 1051-0761.
NAL Call Number: QH540.E23
Descriptors: amphibians, insecticide, effects, experimental ponds, toxicity.

Boone, M.D. and C.M. Bridges (2003). **Effects of pesticides on amphibian populations.** In: R.D. Semlitsch (Editor), *Amphibian Conservation,* Smithsonian Books: Washington, DC, p. 152-167. ISBN: 1588341194.
NAL Call Number: QL644.7 .A47 2003
Descriptors: amphibians, effect of pesticides, fertilizer , pesticide pollution.

Cauble, K. and R.S. Wagner (2005). **Sublethal effects of the herbicide glyphosate on amphibian metamorphosis and development.** *Bulletin of Environmental Contamination and Toxicology* 75(3): 429-435. ISSN: 0007-4861.
NAL Call Number: RA1270.P35A1
Descriptors: frogs, pollutants, contaminants, glyphosate, toxicity testing, larval development.

Christensen, J.R., C.A. Bishop, J.S. Richardson, B. Pauli, and J. Elliott (2004). **Validation of an amphibian sperm inhibition toxicological test method using zinc.** *Environmental Toxicology and Chemistry* 23(12): 2950-2955. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Abstract: Analysis of sperm has been investigated as a possible method to examine the toxicity of environmental contaminants. The amphibian sperm inhibition toxicological test (ASITT) method examines the effects of contaminants on *Xenopus laevis* (African clawed frog) sperm motility and path trajectories. As part of a preliminary validation of the method, the effects of increasing divalent metal ion, zinc (Zn2+), on *X. laevis* sperm motility were examined. We hypothesized that Zn2+ concentration would have significant inhibitory effects on percent sperm motility, velocities, and trajectories. The Zn2+ was added to a control solution in concentrations from 0 to 1,417 microg/L. Sperm cells were videotaped at 30 frames per second under x 400 microscope, and percent motility was recorded and paths were mapped by marking the change in position of the sperm head over a period of 1 s. Sperm motility was categorized as progressive, hyperactivated, idle, or nonmotile, and velocities and trajectories were calculated on the basis of x,y coordinates. Increasing Zn2+ concentrations caused a significant exponential decay in percent total motility and progressive motility. Straight-line velocity increased with increasing Zn2+ concentrations. Overall, results suggest that Zn2+ may be interfering with cellular processes, such as cellular respiration, flagellar bending, or ion exchange, thereby inhibiting sperm motility.

Descriptors: amphibian, toad, *Xenopus laevis*, sperm motility, inhibition, toxicological tests methods, pollutants, zinc, chemical toxicity, reproducibility of results, .

Coskun, B., U. Comelekoglu, A. Polat, and F.F. Kaymaz (2004). **Evaluation of the toxic effects of cypermethrin inhalation on the frog heart.** *Ecotoxicology and Environmental Safety* 57(2): 220-225. ISSN: 0147-6513.
NAL Call Number: QH545.A1E29
Descriptors: frog heart, toxic effects, cypermethrin inhalation, evaluation.

Edginton, A.N., P.M. Sheridan, G.R. Stephenson, D.G. Thompson, and H.J. Boermans (2004). **Comparative effects of pH and Vision herbicide on two life stages of four anuran amphibian species.** *Environmental Toxicology and Chemistry* 23(4): 815-822. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Abstract: Vision, a glyphosate-based herbicide containing a 15% (weight:weight) polyethoxylated tallow amine surfactant blend, and the concurrent factor of pH were tested to determine their interactive effects on early life-stage anurans. Ninety-six-hour laboratory static renewal studies, using the embryonic and larval life stages (Gosner 25) of *Rana clamitans*, *R. pipiens*, *Bufo americanus*, and *Xenopus laevis*, were performed under a central composite rotatable design. Mortality and the prevalence of malformations were modeled using generalized linear models with a profile deviance approach for obtaining confidence intervals. There was a significant ($p < 0.05$) interaction of pH with Vision concentration in all eight models, such that the toxicity of Vision was amplified by elevated pH. The surfactant is the major toxic component of Vision and is hypothesized, in this study, to be the source of the pH interaction. Larvae of *B. americanus* and *R. clamitans* were 1.5 to 3.8 times more sensitive than their corresponding embryos, whereas *X. laevis* and *R. pipiens* larvae were 6.8 to 8.9 times more sensitive. At pH values above 7.5, the Vision concentrations expected to kill 50% of the test larvae in 96-h (96-h lethal concentration [LC50]) were predicted to be below the expected environmental concentration (EEC) as calculated by Canadian regulatory authorities. The EEC value represents a worst-case scenario for aerial Vision application and is calculated assuming an application of the maximum label rate (2.1 kg acid equivalents [a.e.]/ha) into a pond 15 cm in depth. The EEC of 1.4 mg a.e./L (4.5 mg/L Vision) was not exceeded by 96-h LC50 values for the embryo test. The larvae of the four species were comparable in sensitivity. Field studies should be completed using the more sensitive larval life stage to test for Vision toxicity at actual environmental concentrations.
Descriptors: amphibians, anuran, pH, Vision herbicide effects, two life stages, comparative effects, larval life stages.

Ezhili, N., A.A. Sivakumar, and M. Aruchami (2003). **Effect of acid pollution on the haemoglobin and haemotological picture in the frog, *Rana hexadactyla* (Lesson)**. *Journal of Eco Physiology* 6(1/2): 25-32. ISSN: 0972-0413.
Descriptors: amphibians, frog, *Rana hexadactyla*, acid pollution, effect, hemoglobin, hemotological picture.

Feng, S., Z. Kong, X. Wang, L. Zhao, and P. Peng (2004). **Acute toxicity and genotoxicity of two novel pesticides on amphibian, Rana N. Hallowell.** *Chemosphere* 56(5): 457-463. ISSN: 0045-6535.
Descriptors: Rana, frogs, acute toxicity, genotoxicity, imidacloprid, pesticides, DNA damage, RH-5849.

Fenoglio, C., E. Boncompagni, M. Fasola, C. Gandini, S. Comizzoli, G. Milanesi, and S. Barni (2005). **Effects of environmental pollution on the liver parenchymal cells and Kupffer-melanomacrophagic cells of the frog *Rana esculenta*.** *Ecotoxicology and Environmental Safety* 60(3): 259-268. ISSN: 0147-6513.
NAL Call Number: QH545.A1E29
Descriptors: frog, *Rana esculenta*, water pollution, xenobiotics, toxic substances, liver, hepatocytes, enzyme activity, reactive oxygen species, histochemistry.

Fink, N.E. and A. Salibian (2005). **Toxicological studies in adult amphibians: effects of lead.** *Applied Herpetology* 2(3): 311-333 Special Issue. ISSN: 1570-7539.
Descriptors: amphibians, *Bufo arenarum*, toxicological studies, effects of lead.

Greulich, K. and S. Pflugmacher (2003). **Differences in susceptibility of various life stages of amphibians to pesticide exposure.** *Aquatic Toxicology* 65(3): 329-336. ISSN: 0166-445X.
NAL Call Number: QH541.5.W3A6
Abstract: Pesticide exposure is discussed as one of the adverse factor that causes impairment of amphibian larval development. Susceptibility of tadpoles to pesticide exposure differs depending on the developmental stages at which individuals are contaminated. This study focused on the influence of the pyrethroid insecticide cypermethrin on the hatching success, mortality and deformities in further development, duration of metamorphosis, and growth of *Rana arvalis* tadpoles exposed at various life stages. Eggs were harmed significantly by exposure to different concentrations of a-cypermethrin dependent on exposure time. Amphibian embryos hatched with apparent abnormalities indicate insufficient protection by the jelly coat surrounding the embryo. Exposed individuals exhibited typical signs of cyano pyrethroid poisoning (twisting, writhing, abnormal swimming). During the life-stage treatments the observed morphological deformities and behavioral abnormalities lead mostly to death of the tadpoles in later development. Individuals exposed to a-cypermethrin in early life stages (as eggs or newly hatched tadpoles) metamorphosed earlier than in the corresponding control. However, exposure of the tadpoles throughout their whole development prolonged the metamorphosis. These metamorphs were distinguished by a much more compact physique (significant reduction in length and significant increase in weight compared to the corresponding control) so as to resist the adverse conditions. Observed effects of a-cypermethrin exposure on various life stages of R. arvalis tadpoles refer to the danger potential of this insecticide for amphibian development. Any kind of deformation influences the physiological fitness of the individuals (e.g. increased vulnerability to predation). Diminished hatching success, delays in metamorphosis and body growth impact negatively on the viability of amphibian populations in the long term. In combination with other anthropogenic influences (destruction or dissipation of habitats), these effects can cause the local extinction

of amphibian species.
Descriptors: *Rana arvalis*, cypermethrin, pyrethroid insecticides, toxicity, embryo (animal), ova, hatching, developmental stages, metamorphosis, animal growth, abnormal development, water pollution, insecticide residues.

Gurushankara, H.P., S.V. Krishnamurthy, and V. Vasudev (2007). **Effect of Malathion on Survival, Growth, and Food Consumption of Indian Cricket Frog (*Limnonectus limnocharis*) Tadpoles.** *Archives of Environmental Contamination and Toxicology* 52(2): 251-256. ISSN: 0090-4341.
NAL Call Number: TD172.A7
Abstract: The effects of short-term exposure (28 days) of free-feeding *Limnonectus limnocharis* (Indian cricket frog) tadpoles to field concentrations of malathion were investigated. This frog species is a major biotic component of the agroecosystems of the Western Ghats (13degrees 18', 75degrees 25' and 13degrees 22', 75degrees 28'), where malathion (diethyl [(dimethoxy phosphino thioyl] butanediote), an organophosphate pesticide, is being used extensively. Although malathion is known to cause nonreversible acetylcholine inhibition and diminishes activity, growth and development in amphibian tadpoles, such data on Indian amphibian species are lacking. In the present study, increments in the following were used to assess such an impact: tadpole growth; increase in total length, body length, tail length, and body weight; and food consumption. The different concentrations of malathion employed were 500, 1000, 1500, 2000, and 3000 (So(Bg L- superscript 1(B. Malathion exposure produced significant effects on all measured parameters. Tadpole survival decreased from 20 to 6 tadpoles, with an increase in concentration followed by a decrease in growth. Food consumption of surviving tadpoles also decreased (0.067 mg.g- superscript 1(B.d- superscript 1(B to 0.0075 mg.g- superscript 1(B.d- superscript 1(B) with increased malathion. Decreased food consumption, growth, and development of *L. limnocharis* tadpoles with an increase of malathion concentration (within field concentration range) over temporal scale reveal the possible threat to this species in the agroecosystems of the Western Ghats.
Descriptors: cricket frog, *Limnonectus limnocharis*, tadpoles, malathion, exposure, effects, survival, food consumption, growth, development.

Hayes, T., K. Haston, M. Tsui, A. Hoang, C. Haeffele, and A. Vonk (2002). **Feminization of male frogs in the wild.** *Nature* 419(6910): 895-896. ISSN: print: 0028-0836; online: 1476-4687.
NAL Call Number: 472 N21
Descriptors: atrazine, toxicity, *Rana pipiens*, oogenesis, herbicides, herbicide residues, water pollution, males, sex reversal, testicular, oogenesis, United States.

Hayes, T.B., A. Collins, M. Lee, M. Mendoza, N. Noriega, A.A. Stuart, and A. Vonk (2002). **Hermaphroditic, demasculinized frogs after exposure to the herbicide atrazine at low ecologically relevant doses.** *Proceedings of the National Academy of Sciences of the United States of America* 99(8): 5476-5480. ISSN: 0027-8424.
NAL Call Number: 500 N21P
Abstract: Atrazine is the most commonly used herbicide in the U.S. and probably the

world. It can be present at several parts per million in agricultural runoff and can reach 40 parts per billion (ppb) in precipitation. We examined the effects of atrazine on sexual development in African clawed frogs (*Xenopus laevis*). Larvae were exposed to atrazine (0.01-200 ppb) by immersion throughout larval development, and we examined gonadal histology and laryngeal size at metamorphosis. Atrazine (greater than or equal to 0.1 ppb) induced hermaphroditism and demasculinized the larynges of exposed males (greater than or equal to 1.0 ppb). In addition, we examined plasma testosterone levels in sexually mature males. Male *X. laevis* suffered a 10-fold decrease in testosterone levels when exposed to 25 ppb atrazine. We hypothesize that atrazine induces aromatase and promotes the conversion of testosterone to estrogen. This disruption in steroidogenesis likely explains the demasculinization of the male larynx and the production of hermaphrodites. The effective levels reported in the current study are realistic exposures that suggest that other amphibian species exposed to atrazine in the wild could be at risk of impaired sexual development. This widespread compound and other environmental endocrine disruptors may be a factor in global amphibian declines.
Descriptors: frogs, *Xenopus laevis*, atrazine, toxicity, hermaphroditism, testosterone, larynx, muscles, sexual development, males, size.

Hopkins, W.A., S.E. DuRant, B.P. Staub, C.L. Rowe, and B.P. Jackson (2006). **Reproduction, embryonic development, and maternal transfer of contaminants in the amphibian *Gastrophryne carolinensis*.** *Environmental Health Perspectives* 114(5): 661-666. ISSN: 0091-6765.
Online: http://www.ehponline.org/members/2005/8457/8457.html
Descriptors: amphibian, *Gastrophryne carolinensis*, reproduction, contaminanats, embryonic development, maternal transfer.

Khan, M.Z. (2004). **Effect of pesticides on amphibians and reptiles.** *Journal of Experimental Zoology India* 7(1): 39-47. ISSN: 0972-0030.
Descriptors: amphibians, reptiles, pesticides effect, fertilizer, pesticides, pollution, Pakistan.

Kiesecker, J.M. (2002). **Synergism between trematode infection and pesticide exposure: a link to amphibian limb deformities in nature?** *Proceedings of the National Academy of Sciences of the United States of America* 99(15): 9900-9904. ISSN: print: 0027-8424; online: 1091-6490.
NAL Call Number: 500 N21P
Abstract: The apparently rapid increase in the prevalence of amphibian limb deformities has led to substantial interest from ecologists and public health professionals. Hypotheses proposed to explain the deformities fall into two broad categories: chemical contaminants and trematode infection. Although there are convincing experimental demonstrations that certain factors can lead to some deformities, the causes for recent increases in amphibian malformation remain controversial. Moreover, no experimental studies on amphibian deformities have been conducted in the field, and no studies have attempted to examine the synergistic effects of trematode infection and exposure to chemical contaminants. Here, I present the results of field and laboratory experiments that link increased trematode infection, and increased limb deformities, to pesticide exposure. Field experiments conclusively demonstrated that exposure to trematode infection was required for the development of limb deformities in wood frogs,

Rana sylvatica. However, deformities were more common at sites adjacent to agricultural runoff. Laboratory experiments corroborated the association between pesticide exposure and increased infection with pesticide-mediated immunocompetency as the apparent mechanism. Given the conservative contaminant exposure levels used [Environmental Protection Agency (EPA) drinking water standards] and the widespread use of many pesticides, these negative impacts may help to explain pathogen-mediated amphibian declines in many regions.
Descriptors: wood frogs, Rana, trematode infections , Trematoda, water pollution, ponds, runoff, agricultural land, pesticide residues, organochlorine pesticides, organophosphorus pesticides, atrazine, esfenvalerate, limbs (animal), deformities, ribeiroia, telorchis, Pennsylvania.

Mandrillon, A.L. and P. Saglio (2005). **Une revue des effet des pesticides sur la morphologie, le comportement et les traits d'histoire de vie des amphibiens. A review of the effects of pesticides on the morphology, behavior and life history of amphibians.** *Bulletin De La Societe Herpetologique De France* 116: 5-29. ISSN: 0754-9962.
Descriptors: amphibians, pesticides, life history effects, behavior, morphology, review.
Language of Text: French; Summary in English and French.

Mann, R.M.E. (2005). **Methodological approaches in amphibian toxicology.** *Applied Herpetology* 2(3): 221-353 Special Issue. ISSN: 1570-7539.
Descriptors: amphibians, toxicology, methodological approaches.

Marquis, O., A. Millery, S. Guittonneau, and C. Miaud (2006). **Solvent toxicity to amphibian embryos and larvae.** *Chemosphere* 63(5): 889-892. ISSN: 0045-6535.
Abstract: Organic micropollutants are often damaging for aquatic organisms. Being usually hydrophobic compounds, they are often dissolved in an organic co-solvent which increases their solubility in water. The aim of this study was to study the toxicity of various solvents on embryos (protected or not by jelly coat) and on tadpoles of the common frog (*Rana temporaria*). Tested solvents were methanol (MeOH), methylene chloride (CH(2)Cl(2)), dimethyl sulfoxyde (DMSO), acetone (Ac) and ethanol (EtOH). Embryos exhibited higher mortality rates than tadpoles. Embryos with jelly were more sensitive to high concentration of solvents than embryos without jelly (except for acetone). According to these results, Ac, DMSO and CH(2)Cl(2) can be used as co-solvents in water to help the dissolution of micropollutants at concentration equal to or lower than 0.001 ml/l for frog embryos, and EtOH, Ac and CH(2) Cl(2) at concentration equal to or lower than 0.01 ml/l for *Rana temporaria* tadpoles.
Descriptors: frog, *Rana temporaria*, embryonic development drug effects, environmental pollutants toxicity, larva drug effects, solvents toxicity, embryo loss chemically induced, petrolatum pharmacology.

Mautz, W.J. and M.R. Dohm (2004). **Respiratory and behavioral effects of ozone on a lizard and a frog.** *Comparative Biochemistry and Physiology. Part A, Molecular and Integrative Physiology* 139(3): 371-377. ISSN: 1095-6433.
Abstract: Ozone at concentrations found in urban air pollution is known to have significant physiological effects on humans and other mammals. Exposure of the lizard, *Sceloporus*

occidentalis, to 0.6 ppm ozone for 4 h at 25 degrees C induced 1.6 degrees C of behavioral hypothermia immediately following exposure, but selected body temperature recovered to control 35.3 degrees C the next day. Lizards exposed at 35 degrees C to 0.6 ppm ozone for 4 h selected body temperatures 1.9 degrees C below controls after exposure, and the behavioral hypothermic response persisted and increased to 3.3 degrees C the following day. Four-hour exposures of the frog, *Pseudacris cadaverina*, to 0.2 to 0.8 ppm ozone resulted in concentration-dependent alterations of respiration including depression of lung ventilation and oxygen consumption and the adoption of a low profile posture that reduced the exposed body surface. Ozone levels in wilderness habitats downwind of urban sources can potentially have stressful physiological effects on wildlife. Defensive physiological and behavioral reactions to ozone exposure may interfere with routine activities, and oxidant air pollution may be in part responsible for observed wildlife population declines.
Descriptors: lizard, *Sceloporus occidentalis*, frog, *Pseudacris cadaverina*, ozone, behavioral effects, respiratory effects, air pollution, stressful effects.

McDaniel, T.V., P.A. Martin, N. Ross, S. Brown, S. Lesage, and B.D. Pauli (2004). **Effects of chlorinated solvents on four species of North American amphibians**. *Archives of Environmental Contamination and Toxicology* 47(1): 101-109. ISSN: 0090-4341.
NAL Call Number: TD172.A7
Descriptors: amphibians, chlorinated solvents, effects, four species, tetrachlorethylene, North American, pollution, ground water.

Mouchet, F., L. Gauthier, C. Mailhes, V. Ferrier, and A. Devaux (2005). **Comparative study of the comet assay and the micronucleus test in amphibian larvae (*Xenopus laevis*) using benzo(a)pyrene, ethyl methanesulfonate, and methyl methanesulfonate: establishment of a positive control in the amphibian comet assay.** *Environmental Toxicology* 20(1): 74-84. ISSN: 1520-4081.
NAL Call Number: RA1221.T69
Descriptors: frogs, *Xenopus laevis*, pollutants, genotoxicity, biomarkers, toxicity testing, bioassays, DNA damage, screening, dose response.

Ortiz Santaliestra, M.E., A. Marco, M.J. Fernandez, and M. Lizana (2006). **Influence of developmental stage on sensitivity to ammonium nitrate of aquatic stages of amphibians**. *Environmental Toxicology and Chemistry* 25(1): 105-111. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Descriptors: amphibians, develpmental stage, influence, sensitivity, ammonium nitrate, aquatic stages, effect, embryonic, larval.

Orton, F., J.A. Carr, and R.D. Handy (2006). **Effects of nitrate and atrazine on larval development and sexual differentiation in the northern leopard frog *Rana pipiens*.** *Environmental Toxicology and Chemistry* 25(1): 65-71. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Descriptors: leopard frog, *Rana pipiens*, sexual differentiation, larval development, nitrate and atrazine, exposure effects.

Osano, O., W. Admiraal, and D. Otieno (2002). **Developmental disorders in embryos of the frog *Xenopus laevis* induced by chloroacetanilide herbicides and their degradation products.** *Environmental Toxicology and Chemistry* 21(2): 375-379. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Descriptors: frog, *Xenopus laevis*, alachlor, metolachlor, toxicity, animal diseases, embryotoxicity, teratogenesis, derivatives.

Papaefthimiou, C., M.G. Cabral, C. Mixailidou, C.A. Viegas, I. Sa Correia, and G. Theophilidis (2004). **Comparison of two screening bioassays, based on the frog sciatic nerve and yeast cells, for the assessment of herbicide toxicity.** *Environmental Toxicology and Chemistry* 23(5): 1211-1218. ISSN: 0730-7268.
NAL Call Number: QH545.A1E58
Abstract: Two different test systems, one based on the isolated sciatic nerve of an amphibian and the other on a microbial eukaryote, were used for the assessment of herbicide toxicity. More specifically, we determined the deleterious effects of increasing concentrations of herbicides of different chemical classes (phenoxyacetic acids, triazines, and acetamides), and of 2,4-dichlorophenol (2,4-DCP), a degradation product of the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D), on electrophysiological parameters and the vitality of the axons of the isolated sciatic nerve of the frog (*Rana ridibunda*) and on the growth curve of the yeast *Saccharomyces cerevisiae* based on microtiter plate susceptibility assays. The no-observed-effect-concentration (NOEC), defined as the maximum concentration of the tested compound that has no effect on these biological parameters, was estimated. In spite of the different methodological approaches and biological systems compared, the NOEC values were identical and correlated with the lipophilicity of the tested compounds. The relative toxicity established here, 2,4-DCP > alachlor, metolachlor >> metribuzin > 2,4-D, 2-methyl-4-chlorophenoxyacetic acid (MCPA), correlates with the toxicity indexes reported in the literature for freshwater organisms. Based on these results, we suggest that the relatively simple, rapid, and low-cost test systems examined here may be of interest as alternative or complementary tests for toxicological assessment of herbicides.
Descriptors: *Rana*, frog, sciatic nerve , yeast cells, herbicide toxicity, screening bioassays, comparison, amphibian.

Pettersson, I., A. Arukwe, K. Lundstedt Enkel, A. Mortensen, and C. Berg (2006). **Persistent sex-reversal and oviducal agenesis in adult *Xenopus* (Silurana) *tropicalis* frogs following larval exposure to the environmental pollutant ethynylestradiol.** *Aquatic Toxicology* 79(4): 356-365. ISSN: 0166-445X.
NAL Call Number: QH541.5.W3A6
Abstract: It is known that estrogen-like environmental pollutants can feminise gonadal differentiation in frogs resulting in female-biased sex-ratios at metamorphosis. The long-term effects on reproductive function in frogs following larval exposure to pollutants are less known. Amphibian test systems which allow life-cycle studies are therefore needed. The aim of the present study was to characterise long-term estrogenic effects on the reproductive system of the emerging model species *Xenopus* (Silurana) *tropicalis* following larval exposure to ethynylestradiol (EE2). EE2 is a synthetic estrogen that has been detected in sewage efflu-

ents and in surface waters. Newly hatched tadpoles (Niewkoop Faber (NF) stage 48) were exposed to the nominal EE2 concentrations 0 (control), 1, 10, and 100 nM (with analytical chemistry support) until complete metamorphosis (NF stage 66). Effects on the reproductive organs were determined in juveniles (1 month after metamorphosis) and in 9-month-old frogs. Larval exposure to EE2 caused female-biased phenotypic sex-ratios in both juvenile and adult frogs, which is in agreement with previous work on other frog species. Nearly all (97%) of the 63 EE2-exposed 9-month-old frogs had ovaries. Histological evaluation of the gonads of the 9-month-old frogs showed that they were sexually mature. Among the adult frogs with ovaries there was a dose-dependent increase in the frequency of individuals lacking oviducts. Adult frogs exposed to 100 nM EE2 that had ovaries but no oviducts had lower levels of estrogen receptor alpha (ER(Sa(Ba) mRNA in the brain than control animals and those exposed to 100 nM EE2 that had ovaries as well as oviducts. EE2 exposure did not cause any significant changes in ER(Sa(Ba mRNA levels in the ovaries of the adult frogs. The reduced level of ER(Sa(Ba mRNA in the brain of individuals with ovaries lacking oviducts suggests an organizing effect of EE2 on the central nervous system. The results show that transient early life-stage exposure to an environmental pollutant can induce effects on the reproductive organs and the central nervous system that persist into adulthood. Overall, our data suggest that *X. tropicalis*, which has a shorter generation time than the well-established model species *Xenopus laevis*, is a suitable model organism for research on developmental reproductive toxicity in anuran species.

Descriptors: *Xenopus tropicalis*, frogs, water pollution, pollutants, estradiol, long term effects, animal models, toxicity testing, oviducts, reproductive toxicology, messenger RNA, hormone receptors, histology, animal morphology.

Pickford, D.B. and I.D. Morris (2003). **Inhibition of gonadotropin-induced oviposition and ovarian steroidogenesis in the African clawed frog (*Xenopus laevis*) by the pesticide methoxychlor.** *Aquatic Toxicology* 62(3): 179-194. ISSN: 0166-445X.

NAL Call Number: QH541.5.W3A6

Abstract: Concern over the role of environmental toxicants in amphibian population declines has highlighted the need to develop more comprehensive ecotoxicological test methods for this at-risk group. With continued interest in environmental endocrine disrupters (EDs), and the paucity of data pertaining to endocrine disrupting effects in amphibia, such tests should incorporate reproductive and endocrine endpoints. We investigated the effects of in vivo exposure to the pesticide methoxychlor (MXC) on reproductive and endocrine function in adult female African clawed frogs, (*Xenopus laevis*). Frogs were exposed to MXC (0.5-500 micrograms/l) in tank water throughout a cycle of oogenesis stimulated by exogenous gonadotropins. Gonadotropin-induced oviposition was delayed, and reduced numbers of unfertilizable eggs of increased size were oviposited by frogs exposed to 500 micrograms/l MXC. Reduced egg output was mirrored by increased gonado-somatic index in MXC-treated frogs. Post-oviposition, plasma sex steroid profiles were altered in MXC-exposed frogs as estradiol/progesterone and estradiol/testosterone ratios were elevated. Ex vivo synthesis of progesterone by ovarian explants was significantly reduced for frogs exposed to MXC > or = to 0.5 micrograms/l. Additionally, plasma vitellogenin concentrations were significantly depressed in frogs exposed to 500 micrograms/l MXC. These data indicate that

reproductive and endocrine dysfunction can occur in adult amphibia exposed to high concentrations of an environmental toxin with endocrine disrupting activity. Such effects may be indicative of the potential for adverse effects on amphibian wildlife exposed to environmental EDs.
Descriptors: African clawed frog, *Xenopus laevis*, methoxychlor, insecticides, toxicity, oviposition, steroidogenesis, ovaries, gonadotropins, estradiol, progesterone, testosterone, blood plasma, ova, gonadosomatic index, vitellogenins, ratios.

Relyea, R.A., N.M. Schoeppner, and J.T. Hoverman (2005). **Pesticides and amphibians: the importance of community context.** *Ecological Applications* 15(4): 1125-1134. ISSN: 1051-0761.
NAL Call Number: QH540.E23
Descriptors: malathion, insecticide residues, glyphosate, herbicide residues, ecotoxicology, toxicity, *Hyla*, *Bufo americanus*, *Rana pipiens*, developmental stages, adult animals, food webs, community ecology, predators, predator prey relationships, water pollution, Dytiscidae, aquatic organisms, *Dytiscus*, *Notophthalmus viridescens*, eastern newt.

Relyea, R. (2005). **The lethal impact of roundup on aquatic and terrestrial amphibians.** *Ecological Applications* 15(4): 1118-1124. ISSN: 1051-0761.
NAL Call Number: QH540.E23
Descriptors: glyphosate, herbicide residues, toxicity, amphibians, *Rana pipiens*, *Bufo americanus*, *Hyla versicolor*, adult animals, developmental stages, ecotoxicology, soil pollution, water pollution, adsorption, loam soils, sand.

Roy, D. (2002). **Amphibians as environmental sentinels**. *Journal of Biosciences* 27(3): 187-188. ISSN: 0250-5991.
Online: http://www.ias.ac.in/jbiosci/jun2002/187.pdf
NAL Call Number: QH1.J63
Descriptors: amphibians, environmental sentinals, pollution, toxic chemicals, contamination.

Sampath, K., I.J.J. Kennedy, and R. James (2002). **Pesticide impact on excretory physiology of the common frog, *Rana tigrina* (Daud) tadpoles.** *Bulletin of Environmental Contamination and Toxicology* 68(5): 652-659. ISSN: print: 0007-4861; online: 1432-0800.
NAL Call Number: RA1270.P35A1
Descriptors: toxicity, frog, *Rana tigrina*, tadpoles, pesticide impact, excretory physiology.

Sanzo, D. and S.J. Hecnar (2006). **Effects of road de-icing salt (NaCl) on larval wood frogs (*Rana sylvatica*).** *Environmental Pollution* 140(2): 247-256. ISSN: 0269-7491.
NAL Call Number: QH545.A1E52
Descriptors: larval wood frog, *Rana sylvatica*, road de-icing salt, chemical pollution, effects.

Song, M.O., D.J. Fort, D.L. Mclaughlin, R.L. Rogers, J.H. Thomas, B.O. Buzzard, A.M. Noll, and N.K. Myers (2003). **Evaluation of *Xenopus tropicalis* as an alternative test organism for frog embryo teratogenesis assay: Xenopus (fetax).** *Drug and Chemical Toxicology* 26(3): 177-189. ISSN: print: 0148-0545; online: 1525-6014.

NAL Call Number: QP901.D7
Descriptors: amphibians, *Xenopus tropicalis*, frog embryo, teratogenesis assay, test organism, alternative, evaluation, ICCVAM.

Sparling, D.W. and G. Harvey (2006). **Comparative toxicity of ammonium and perchlorate to Amphibians.** *Bulletin of Environmental Contamination and Toxicology* 76(2): 210-217. ISSN: print: 0007-4861; online: 1432-0800.
NAL Call Number: RA1270.P35A1
Descriptors: amphibians, ammonium, perchlorate, comparative toxicity, contamination, environment.

Steinberg, C.E.W., S. Hoss, W. Kloas, I. Lutz, T. Meinelt, S. Pflugmacher, and C. Wiegand (2004). **Hormonelike effects of humic substances on fish, amphibians, and invertebrates.** *Environmental Toxicology* 19(4): 409-411. ISSN: print: 1520-4081; online: 1522-7278.
NAL Call Number: RA1221.T69
Descriptors: amphibians, fish, invertebrates, humic substances, hormonelike effects, toxicity.
Notes: In the special issue: 11th International Symposium on Toxicity Assessment / edited by L. Manusadzianas. Includes references.

Ultraviolet Radiation

Adkins, E., T. Driggers, G. Ferguson, W. Gehrmann, Z. Gyimesi, E. May, M. Ogle, and T. Owens (2003). **Ultraviolet light and reptiles, amphibians.** *Journal of Herpetological Medicine and Surgery* 13(4): 27-37. ISSN: 1529-9651.
NAL Call Number: SF997.5.R4 B85
Descriptors: amphibians, reptiles, ultraviolet light, care in captivity, UV light importance, deficiencies.

Belden, L.K. and A.R. Blaustein (2002). **Exposure of red-legged frog embryos to ambient UV-B radiation in the field negatively affects larval growth and development.** *Oecologia* 130(4): 551-554. ISSN: 0029-8549.
NAL Call Number: QL750.O3
Descriptors: frog, embryos, ambient UV-B radiation, exposure, larval growth, development, negative affects.

Belden, L.K. and A.R. Blaustein (2002). **UV-B induced skin darkening in larval salamanders does not prevent sublethal effects of exposure on growth.** *Copeia* 2002(3): 748-754. ISSN: 0045-8511.
Descriptors: amphibians, salamander, *Ambystoma gracile*, *Ambystoma macrodactylum*, *Taricha granulosa*, Salamandridae, color pigments, melanin production, UV-B induced skin darkening in larvae, implications for growth and survival, skin, larval development, growth, survival, light, UV-B.

Blaustein, A.R. and L.K. Belden (2003). **Amphibian defenses against ultraviolet-B radiation.** *Evolution and Development* 5(1): 89-97. ISSN: 1520-541X.
Descriptors: amphibians, biological effects, defense mechanisms, UV B radiation, defense mechanisms.

Calfee, R.D., C.M. Bridges, and E.E. Little (2006). **Sensitivity of two salamander (*Ambystoma*) species to ultraviolet radiation.** *Journal of Herpetology* 40(1): 35-42. ISSN: 0022-1511.
NAL Call Number: QL640.J6
Descriptors: amphibians, spotted salamander, mole salamander, ultraviolet radiation, sensitivity, embryos, larvae, UV-B.

Cummins, C.P. (2003). **UV-B radiation, climate change and frogs - the importance of phenology.** *Annales Zoologici Fennici* 40(1): 61-67. ISSN: 0003-455X.
NAL Call Number: 410 AN712
Descriptors: frogs, *Rana temoraria*, climate change, UV-B radiation, effects, importance of phenology.

Cummins, C.P. (2002). **Testing for effects of UV-B radiation on anti-predator behavior in amphibians: A critique and some suggestions.** *Ethology* 108(7): 643-648. ISSN: 0179-1613.
NAL Call Number: QL750.E74
Descriptors: toad, *Bufo boreas*, frog, *Rana cascadae*, *Taricha granulosa*, salamander, behavioral techniques, avoidance behavior, anti predator behavior, effects of UV B exposure, experimental design considerations, light, UV B radiation.

Formicki, G., W. Zamachowski, and R. Stawarz (2003). **Effects of UV-A and UV-B on oxygen consumption in common toad (*Bufo bufo*) tadpoles.** *Journal of Zoology* 259(3): 317-326. ISSN: 0952-8369.
Descriptors: amphibians, common toad, *Bufo bufo*, tadpoles, oxygen consumption, UV- A, UV- B, exposure effect.

Hatch, A.C. and A.R. Blaustein (2003). **Combined effects of UV-B radiation and nitrate fertilizer on larval amphibians.** *Ecological Applications* 13(4): 1083-1093. ISSN: 1051-0761.
NAL Call Number: QH540.E23
Descriptors: amphibians, *Ambystoma macrodactylum*, UV-B radiation, nitrate fertilizer, larval amphibians, combined effects.

Licht, L.E. (2003). **Shedding light on ultraviolet radiation and amphibian embryos.** *Bioscience* 53(6): 551-561. ISSN: 0006-3568.
Descriptors: amphibians, UV-B radiation, amphibian embryos, effects.

Little, E.E., R.D. Calfee, D.L. Fabacher, C. Carey, V.S. Blazer, and E.M. Middleton (2003). **Effects of ultraviolet radiation on toad early life stages.** *Environmental Science and Pollution Research International* 10(3): 167-172. ISSN: 0944-1344.
Descriptors: amphibians, toad, *Bufo* ultraviolet radiation, early life stages, effects, UVB, solar radiation, harmful levels.

Pahkala, M., A. Laurila, and J. Merila (2003). **Effects of ultraviolet-B radiation on behaviour and growth of three species of amphibian larvae.** *Chemosphere* 51(3): 197-204. ISSN: 0045-6535.
Abstract: Effects of ultraviolet-B (UV-B) radiation on amphibian embryos have been investigated in a number of studies, but the effects on larvae have received less attention. We investigated the effects of UV-B radiation on the behaviour and growth of larvae of three amphibians (*Rana arvalis*, *Rana temporaria* and *Bufo bufo*) in two different experiments. First, we tested whether larvae of the three species actively avoid UV-B exposure if given a choice. We found no evidence for active avoidance of UV-B or changes in activity in the presence of UV-B in any of the species. Second, we assessed the effects of natural (1.25 kJm(-2)) and enhanced (1.58 kJm(-2)) UV-B radiation on the survival and growth of the three species and found that the exposure to UV-B radiation did not have any effect on survival rates of any of the species. However, UV-B radiation had a positive effect on the growth of *R. arvalis* and *R. temporaria*, whereas the growth of *B. bufo* tadpoles was unaffected by the UV-B treatments.

Our results suggest that a short-term exposure to UV-B radiation does not induce any UV-B avoidance behaviour in tadpoles of these three species. Furthermore, unlike some previous studies, the results suggest that the young tadpoles of these species are not negatively affected by UV-B radiation. In fact, our results demonstrate that a moderate amount of UV-B radiation enhance tadpole growth rates in two of the three species.
Descriptors: amphibians, ultraviolet radiation, effects, behavior, growth, amphibian larvae, three species, embryos, UV-B.

Pahkala, M., J. Merila, I. Ots, and A. Laurila (2003). **Effects of ultraviolet-B radiation on metamorphic traits in the common frog *rana temporaria*.** *Journal of Zoology* 259(1): 57-62. ISSN: 0952-8369.
Descriptors: amphibians, common frog, *Rana temporaria*, ultraviolet-B, effects, metamorphic traits, larval development, embryonic development.

Pahkala, M., A. Laurila, and J. Merila (2002). **Effects of ultraviolet-B radiation on common frog *Rana temporaria* embryos from along a latitudinal gradient.** *Oecologia Berlin* 133(4): 458-465. ISSN: 0029-8549.
Descriptors: common frog, *Rana temporaria*, ultraviolet-B radiation, effects, embryos, amphibians, tolerance.

Pahkala, M., K. Rasanen, A. Laurila, U. Johanson, L.O. Bjorn, and J. Merila (2002). **Lethal and sublethal effects of uv-b/ph synergism on common frog embryos**. *Conservation Biology* 16(4): 1063-1073. ISSN: 0888-8892.
NAL Call Number: QH75.A1C5
Descriptors: amphibians, frog embryos, ultraviolet-B, sublethal effects, lethal effects, synergistic effectcs, pH, stressors, *Rana temporaria.*

Peterson, G.S., L.B. Johnson, R.P. Axler, and S.A. Diamond (2002). **Assessment of the risk of solar ultraviolet radiation to amphibians. II. In situ characterization of exposure in amphibian habitats.** *Environmental Science and Technology* 36(13): 2859-2865. ISSN: 0013-936X.
NAL Call Number: TD420.A1E5
Descriptors: amphibians, *Rana pipiens*, behavior, habitat utilization, semiaquatic habitat, wetlands, light, solar UV radiation, exposure risks in wetland habitats, north, UV exposure risks, influencing factors, wetland habitats, Minnesota, USA.

Scheessele, E.A., T.S. Garcia, and A.R. Blaustein (2003). **Indirect effects of ultraviolet-B radiation on amphibians: using mesocosm experiments to examine UV-B effects on trophic level interactions.** *Ecological Society of America Annual Meeting Abstracts* 88: 298. ISSN: 0012-9623.
Descriptors: amphibians, ultraviolet b radiation, indirect effects, trophic level interactions, mesocism experiments, meeting.
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.

Trenham, P.C. and S.A. Diamond (2005). **Coordinated studies of ultraviolet radiation and amphibians in lentic wetland habitats.** *Ecosystems* 8(5): 455-461. ISSN: 1432-9840.
NAL Call Number: QH540.E3645
Descriptors: ozone depletion, ultraviolet radiation, solar radiation, amphibians, wetlands, research methods, mortality, human health, bioindicators, literature reviews, population decline.
Notes: In the special section: Ultraviolet Radiation and Amphibians in Lentic Wetlands.

Weyrauch, S.L. and T.C.J. Grubb (2006). **Effects of the interaction between genetic diversity and UV-B radiation on wood frog fitness.** *Conservation Biology* 20(3): 802-810. ISSN: 0888-8892.
NAL Call Number: QH75.A1C5
Descriptors: wood frog, *Rana sylvatica*, UV-B radiation, genetic diversity, effects on fitness, environmental stressor.
Language of Text: English; Spanish.

Veterinary

Annis, S.L., F.P. Dastoor, H. Ziel, P. Daszak, and J.E. Longcore (2004). **A DNA-based assay identifies *Batrachochytrium dendrobatidis* in amphibians.** *Journal of Wildlife Diseases* 40(3): 420-428. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: amphibians, fungal pathogen, detection, DNA based assay, diagnostic techniques, fungal diseases, *Batrachochytrium dendrobatidis*.

Baier, J. (2006). **Guidelines for euthanasia of nondomestic animals.** In: C.K. Baer *Amphibians,* American Association of Zoo Veterinarians: Lawrence, USA, p. 39-41. ISBN: 0689707266.
Descriptors: animal welfare, drugs, euthanasia, guidelines, methodology, techniques, nondomestic animals, zoo animals, amphibians, book chapter.

Bertelsen, M. and G. Crawshaw (2003). **5-Minute guide to amphibian disease**. *Exotic DVM* 5(2): 23-26. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: amphibians, diseases, guide, diagnosis, verterinary resource.

Boyle, D.G., D.B. Boyle, V. Olsen, J.A.T. Morgan, and A.D. Hyatt (2004). **Rapid quantitative detection of chytridiomycosis (*Batrachochytrium dendrobatis*) in amphibian samples using real-time Taqman PCR assay.** *Diseases of Aquatic Organisms* 60(2): 141-148. ISSN: 0177-5103.
Online: http://dx.doi.org/10.3354/dao060141
Descriptors: amphibians, anura , diagnostic techniques, *Batrachochytrium dendrobatis* (fungus), detection using pcr Taqman assay, fungal diseases.

Clayton, L.A. (2005). **Amphibian gastroenterology.** *Veterinary Clinics of North America, Exotic Animal Practice* 8(2): 227-245. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Descriptors: amphibians, gastroenterology, diagnostic techniques, treatment, gastrointestinal tract, anatomy, gastrointestinal diseases.

Collins, J.P., J.L. Brunner, J.K. Jancovich, and D.M. Schock (2004). **A model host-pathogen system for studying infectious disease dynamics in amphibians: tiger salamanders (*Ambystoma tigrinum*) and *Ambystoma tigrinum* virus.** *Herpetological Journal* 14(4): 195-200. ISSN: 0268-0130.
Descriptors: amphibians, tiger salamanders, *Ambystoma tigrinum*, model host pathogen system, studying infectious disease, dynamics, virus.

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.

de la Navarre, B.J. (2006). **Common procedures in reptiles and amphibians.** *Veterinary Clinics of North America, Exotic Animal Practice* 9(2): 237-267. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Reptiles and amphibians continue to be popular as pets in the United States and throughout the world. It therefore behooves veterinarians interested in caring for these exotic species to continually gather knowledge concerning both their proper husbandry and the conditions that require medical and/or surgical intervention.This article covers husbandry, physical examination, and clinical and diagnostic techniques in an effort to present guidelines for the evaluation of the reptile or amphibian patient. Gathering clinical data will aid veterinarians in arriving at the proper diagnosis,increasing the chances of success with treatment protocols, and educating the clients in proper nutrition and husbandry for their pets.
Descriptors: Amphibia, animal diseases diagnosis, therapy, reptiles, veterinary medicine methods, animal feed, animal husbandry methods, standards, animal nutrition, physiology, domestic animals, diagnosis, diagnostic services, standards, physical examination veterinary, practice guidelines, veterinary medicine standards.

De Martini, L., F. Oneto, M.V. Pastorino, S. Salvidio, E. Buriola, and F. Bona (2006). **A non-lethal method to sample gastrointestinal parasites from terrestrial salamanders**. *Amphibia Reptilia* 27(2): 278-280. ISSN: 0173-5373.
Descriptors: amphibians, gastrointestinal parasites, sample methods, non-lethal, terrestrial salamanders.

Ells, T.v., J. Stanton, A. Strieby, P. Daszak, A.D. Hyatt, and C. Brown (2003). **Use of immunohistochemistry to diagnose chytridiomycosis in dying poison dart frogs (*Dendrobates tinctorius*).** *Journal of Wildlife Diseases* 39(3): 742-745. ISSN: 0090-3558.
NAL Call Number: 41.9 W64B
Descriptors: poison dart frogs, *Dendrobates tinctorius*, Anura, dermatomycoses, Chytridiales, disease, diagnosis, *Batrachochytrium dendrobatis*.

Guenette, S.A., P. Helie, F. Beaudry, and P. Vachon (2007). **Eugenol for anesthesia of African clawed frogs (*Xenopus laevis*)**. *Veterinary Anaesthesia and Analgesia* 34(3): 164-170. ISSN: print: 1467-2987; online: 1467-2995.
Abstract: OBJECTIVE: To determine the level of anesthesia attained in *Xenopus laevis* frogs with eugenol at different doses and by different routes of administration. STUDY DESIGN: Prospective experimental trial. ANIMALS: Sixty *X. laevis* nonbreeding female frogs weighing between 90 and 140 g. METHODS: Three different routes of administration were tested - subcutaneous injections into the dorsal lymph sacs, topical administration using a gauze patch, and immersion in a bath containing eugenol. Following the determination of the best route of administration, the acetic acid test, the withdrawal reflex, righting reflex, heart rate,

and respiratory frequency were used to evaluate central nervous system depression following eugenol bath administration. In an additional group, the response to a surgical incision of the abdominal wall was evaluated. The pharmacokinetics of eugenol were determined following bath immersion administration, and pharmacokinetic parameters were calculated following blood concentration determination by tandem liquid chromatography/mass spectrometry analyses. RESULTS: It was not possible to induce anethesia with subcutaneous and patch administration, independent of the eugenol dose administered. The immersion bath was the only efficacious route for anesthesia inducing surgical anesthesia for at least 30 minutes with postoperative analgesia. Histopathology of selected tissues (heart, lung, liver, kidneys, eyes) showed no evidence of lesions 24 hours following bath immersion. The elimination half-life (T(1/2)) was 4 hours. CONCLUSIONS: When administered as a single-bath immersion (dose 350 mg L(-1)) for 15 minutes, eugenol may serve as an effective anesthetic in *Xenopus laevis* frogs for short surgical procedures.
Descriptors: African clawed frogs, *Xenopus laevis*, amphibians, anesthesia, eugenol, doses, routes of administration, subcutaneous, topical, immersion bath, pharmacokinetics, blood concentration, surgical anesthesia.

Guenette, S.A. and S. Lair (2006). **Anesthesia of the leopard frog, *Rana pipiens*: a comparative study between four different agents**. *Journal of Herpetological Medicine and Surgery* 16(2): 38-44. ISSN: 1529-9651.
Online: http://www.arav.org/Journals/J053TI.htm
NAL Call Number: SF997.5.R4 B85
Descriptors: amphibians, leopard frog, *Rana pipiens*, anesthesia, anesthetics, benzocaine, drug combinations, lidocaine, pharmacodynamics, pharmacokinetics, pharmacology, comparative study, clove oil.

Guenette, S.A., D. Rodrigue, and P. Vachon (2005). **Utilisation des amphibiens en recherche: l'eugenol pour la gestion de la douleur chez la grenouille *Xenopus laevis*. [Utilization of amphibians in research: Eugenol in pain management in *Xenopus laevis*]**. *Medecin Veterinaire Du Quebec* 35(1): 12-14. ISSN: 0225-9591.
Descriptors: amphibians, frogs , *Xenopus laevis*, analgesics, eugenol, laboratory animals, pain management, research.
Language of Text: French.
Notes: Special issue: Medecine des animaux de laboratoire.

Hadfield, C.A. and B.R. Whitaker (2005). **Amphibian emergency medicine and care.** *Seminars in Avian and Exotic Pet Medicine* 14(2): 79-89. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: amphibians, treatment techniques, emergency medicine and care, pets, research animals, diseases, injuries.

Harkewicz, K., A.P. Pessier, L.A. Rollins Smith, R. Speare, and C. Weldon (2005). **Amphibian chytridiomycosis.** *Journal of Herpetological Medicine and Surgery* 15(3): 32-44. ISSN: 1529-9651.

NAL Call Number: SF997.5.R4 B85
Descriptors: amphibians, fungal disease, chytridiomycosis, treatment techniques, transmission, diagnosis.

Hassl, A. and G. Benyr (2003). **Hygienic evaluation of terraria inhabited by amphibians and reptiles: Cryptosporidia, free-living amebas, *Salmonella*.** *Wiener Klinische Wochenschrift* 115(Suppl.3): 68-71. ISSN: 0043-5325.
Descriptors: amphibians, reptiles, hygenic evaluation, Cryptosporidia, amebas, *Salmonella*, pets, disease transmission, vivarium, infectious diseases.
Language of Text: German.
Notes: Meeting Information: Vortrage der 36. jahrestagung der Osterreichischen Gesellschaft fur Tropenmedizin und Parasitologie.

Johnson, A.J. and J.F.X. Wellehan (2005). **Amphibian virology.** *Veterinary Clinics of North America, Exotic Animal Practice* 8(1): 53-65. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Descriptors: amphibian virology, virology, veterinary clinics, review, viral diseases.

Keller, C.B. and C.M. Shilton (2002). **The amphibian eye.** *Veterinary Clinics of North America, Exotic Animal Practice* 5(2): 261-274. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Descriptors: amphibians, the amphibian eye, diagnostic techniques, ophthalmic diseases, veterinary.

Kirk Baer, C.E. (2006). **Proceedings Association of Reptilian and Amphibian Veterinarians thirteenth annual conference. Baltimore, Maryland, April 23-27, 2006.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 13: 1-126. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: amphibians, reptilians , veterinary conference, proceedings, diagnostic techniques, abstracts, treatment techniques, parasites, diseases, disorders.

Knapp, R.A. and J.A.T. Morgan (2006). **Tadpole mouthpart depigmentation as an accurate indicator of chytridiomycosis, an emerging disease of amphibians.** *Copeia* 2006(2): 188-197. ISSN: 0045-8511.
Descriptors: amphibians, emerging diseases, tadpole mouthpart depigmentation as accurate indicator of fungal disease, chytridiomycosis.

Kriger, K.M., H.B. Hines, A.D. Hyatt, D.G. Boyle, and J.M. Hero (2006). **Techniques for detecting chytridiomycosis in wild frogs: Comparing histology with real-time taqman pcr**. *Diseases of Aquatic Organisms* 71(2): 141-148. ISSN: 0177-5103.
Online: http://dx.doi.org/10.3354/dao071141
Descriptors: amphibians, wild frogs, chytridiomycosis, detecting techniques, PCR assay, rapid, noninvasive, swab PCR.

Li, M.h., W. Li, W. Zhou, Q. Zhang, and F.l. Li (2006). **Comparative anatomy of respiratory system of three frogs and discussion on their evolutive relationship.** *Sichuan Journal of Zoology* 25(2): 223-227. ISSN: 1000-7083.
Descriptors: amphibians, frogs, respiratory system, comparative anatomy, discussion, evolution.
Language of Text: Chinese; Summary in Chinese and English.

Maclean, B. (2006). **Common dermatoses of ornamental fish and amphibians.** *In Practice* 28(10): 604-613. ISSN: 0263-841X.
Descriptors: ornamental fish, amphibians, skin diseases, skin lesions , signs, symptoms (animals and humans), animal pathogens, disease diagnosis, clinical examination, medical treatment.

Miller, D.L., M.J. Gray, S. Rajeev, and C.A. Baldwin (2006). **Preliminary pathologic findings in bullfrog (*Rana catesbiana*) and green frog (*Rana clamitans*) larvae collected from farm ponds in Tennessee.** *Proceedings of the Annual Conference of the Association of Reptilian and Amphibian Veterinarians* 13: 1-3. ISSN: 1529-9651.
NAL Call Number: SF996.A77
Descriptors: amphibians, bullfrog, *Rana catesbiana*, green frog, *Rana clamitans*, larvae pathologic findings, farm pools, Tennessee, conference proceedings.

Mohan, S. and C.W. Stevens (2006). **Systemic and spinal administration of the mu opioid, remifentanil, produces antinociception in amphibians.** *European Journal of Pharmacology* 534(1-3): 89-94. ISSN: 0014-2999.
Abstract: Remifentanil is a relatively new opioid analgesic related to the fentanyl family of mu opioid receptor agonists and is used clinically for its unique property of having an ultra-short duration of action. However, there is little preclinical data on the analgesic (antinociceptive) effects of remifentanil and none obtained in non-mammalian animal models. The antinociceptive effects of remifentanil were assessed by using the acetic acid test in amphibians. Systemic and spinal administration of remifentanil was made by subcutaneous and intraspinal injections in the Northern grass frog, *Rana pipiens*. After administration, remifentanil produced dose-dependent and long-lasting antinociceptive effects which persisted for five hours after systemic administration but gave a shorter duration of action after spinal delivery. The antinociceptive effects of remifentanil were significantly blocked by pretreatment with systemic naltrexone. Systemic and spinal administration of remifentanil produced log dose-response curves which yielded ED50 values of 7.1 nmol/g and 3.2 nmol/animal respectively. The relative antinociceptive potency of remifentanil compared to other opioids administered to amphibians is similar to that found in mammalian models.
Descriptors: Northern grass frog, *Rana pipiens*, analgesics, opioid pharmacology, pain prevention and control, piperidines pharmacology, acetic acid, analgesics, opioid administration and dosage, dose response relationship, drug, injections, spinal, injections, subcutaneous, models, animal, naltrexone pharmacology, narcotic antagonists pharmacology, pain measurement, piperidines administration and dosage, receptors, opioid, mu drug effects, time factors.

Monks, D.J., M.S. Carlisle, M. Carrigan, K. Rose, D. Spratt, A. Gallagher, and P. Prociv (2005). ***Angiostrongylus cantonensis* as a cause of cerebrospinal disease in a yellow-tailed black cockatoo (*Calyptorhynchus funereus*) and two tawny frogmouths (*Podargus strigoides*).** *Journal of Avian Medicine and Surgery* 19(4): 289-293. ISSN: 1082-6742.
NAL Call Number: SF994.J6
Descriptors: amphibians, *Angiostrongylus cantonensis*, cockatoo, *Calyptorhynchus funereus*, tawny frogmouths, *Podargus strigoides*, cerebrospinal disease, Australia.

Mutschmann, F. (2004). **Pathological changes in African hyperoliid frogs due to a myxosporidian infection with a new species of Hoferellus (Myxozoa).** *Diseases of Aquatic Organisms* 60(3): 215-222. ISSN: print: 0177-5103; online: 1616-1580.
Online: http://dx.doi.org/10.3354/dao060215
Abstract: A proliferous, polycystic and sometimes fatal kidney disease due to an infection with myxosporidia is reported in 24 of 28 hyperoliid frogs (*Afrixalus dorsalis*, *Hyperolius concolor*, Hyperolius sp.) from Nigeria, Ghana and Tanzania. In line with pathological changes in fish, the disease is described as 'frog kidney enlargement disease' (FKED). *Myxosporidian plasmodi*a, different developmental stages and spores occurred in the kidney, ureter, and urinary bladder and in the intestine of the frogs. The parasite belongs to the genus Hoferellus and is presented as a new species: *H. anurae n*. sp. Spores are similar in size and structure to other Hoferellus species in fish but differ by the presence of a more prominent suture line and shorter caudal appendages. This is the first report on a Hoferellus species in amphibians as well as the first report of the genus Hoferellus in African vertebrates.
Descriptors: frogs, pathological changes, infection , myxosporidian, new species, Hoferellus, fatal kidney disease, ureter, urinary bladder, intestine, parasite.

Mylniczenko, N.D. (2006). **A medical health survey of diseases in captive caecilian amphibians**. *Journal of Herpetological Medicine and Surgery* 16(4): 120-128. ISSN: 1529-9651.
Online: http://www.arav.org/Journals/J053TI.htm
NAL Call Number: SF997.5.R4 B85
Descriptors: amphibians, diseases, survey, captive, fecal examintions, antemortem, post-mortem, examination, therapy, antibiotics, treatments, medical care, microbial cultures, septicemia.

O'Malley, B. (2005). ***Clinical Anatomy and Physiology of Exotic Species: Structure and Function of Mammals, Birds, Reptiles and Amphibians.***, Elsevier Saunders: Edinburgh and New York, 269 p. ISBN: 0702027820.
NAL Call Number: SF997.5.E95 O44 2005
Descriptors: amphibians, birds, reptiles, mammals, clinical anatomy, physiology, exotic animals.

Pare, J.A. (2004). **Un apercu de la medecine des amphibiens. [General survey of amphibian medicine].** *Medecin Veterinaire Du Quebec* 34(4): 275-280. ISSN: 0225-9591.
Descriptors: amphibians, pets, diseases, medicine, survey, Quebec.
Language of Text: French.

Parker, J.M., I. Mikaelian, N. Hahn, and H.E. Diggs (2002). **Clinical diagnosis and treatment of epidermal chytridiomycosis in African clawed frogs (*Xenopus tropicalis*).** *Comparative Medicine* 52(3): 265-268. ISSN: 1532-0820.
NAL Call Number: SF77.C65
Abstract: An investigation was conducted to determine the cause of morbidity and mortality in a collection of 55 adult male *Xenopus* (Silurana) tropicalis at the University of California, Berkeley. More than 80% of affected frogs died during the epizootic. All frogs were anorectic and lethargic, had dark pigmentation and excess skin sloughing, and lacked a slime layer. Histologic examination revealed severe hyperplastic and spongiotic dermatitis associated with colonization of the stratum corneum by large numbers of zoosporangia diagnostic of *Batrachochytrium dendrobatidis*. Treatment with a commercial formalin/malachite green solution at a dilution of 0.007 ml/L of tank water for 24 h, repeated every other day for four treatments, eliminated the organism and was curative. These findings are indicative of epidermal chytridiomycosis as a primary cause of death in this collection of *X. tropicalis.*
Descriptors: *Xenopus*, laboratory animals, mortality, Chytridiales, dermatomycoses, epidemiology, histopathology, case studies, Silurana tropicalis, *Batrachochytrium dendrobatidis.*

Pessier, A.P. (2007). **Cytologic diagnosis of disease in amphibians.** *Veterinary Clinics of North America, Exotic Animal Practice* 10(1): 187-206. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Cytology is an inexpensive yet powerful diagnostic tool that allows for rapid diagnosis of many common disease conditions in amphibian patients. Although the emphasis of this article is on infectious diseases, there is great potential for application of cytologic diagnosis to variety of medical conditions as the knowledge base in amphibian medicine and pathology continues to grow. Routine methods used that may fall under the umbrella of cytology range from wet mount examination of skin scrapings (or gill biopsies of larvae) to examination of stained impression smears. Routine Romanowsky's-type stains work well for amphibian samples. Preparation of multiple smears is always recommended to allow for use of special staining procedures.
Descriptors: amphibians, parasitology, cytodiagnosis, veterinary, skin diseases, animal diseases, pathology, body fluids, cytology, microbiology, parasitology.

Pessier, A.P. and M. Pinkerton (2003). **Practical gross necropsy of amphibians.** *Seminars in Avian and Exotic Pet Medicine* 12(2): 81-88. ISSN: 1055-937X.
NAL Call Number: SF994.2.A1S36
Descriptors: amphibians, practical gross necropsy, methods, veterinary.

Skalka, P. (2002). **Diagnostika a leceni zab v ustecke Zoo. Diagnostics and treatment of frogs at the Usti nad Labem Zoo.** *Fauna Bohemiae Septentrionalis* 27: 31-35. ISSN: 0231-9861.
Descriptors: amphibians, Anura, diagnostics, zoo, treatment, parasites, frogs, usti nad labem zoo.
Language of Text: Czech; Summary in Czech and English.

Skalka, P. (2003). **Diagnostika a leceni zab. [Diagnosis and treatment of frogs.]**. *Akvarium Terarium* 46(2): 64-67. ISSN: 0002-3930.
Descriptors: amphibians, Anura, frogs, diagnosis, parasites, diseases, disorders, captivity, treatment.
Language of Text: Czech.

Smith, K.G. (2007). **Use of quantitative PCR assay for amphibian chytrid detection: Comment on Kriger et al. (2006a,b).** *Diseases of Aquatic Organisms* 73(3): 253-255. ISSN: print: 0177-5103; online: 1616-1580.
Descriptors: amphibians, parasitology, chytridiomycota, isolation, purification, mycoses, assay, polymerase chain reaction, chytridiomycota genetics, diagnosis, spores, fungal isolation.
Notes: Comment On: Dis Aquat Organ. 2006 Jul 25;71(2):141-8.

Stacy, B.A. and J.M. Parker (2004). **Amphibian Oncology.** *Veterinary Clinics of North America, Exotic Animal Practice* 7(3): 673-695. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Spontaneous neoplasia is rare in all three orders of Amphibia.Tumors are documented in most major organ systems, and some have various underlying etiologies, including viral infection, environmental contaminants, and genetic predisposition. Currently,treatment options are limited to removal of the predisposing condition(s), palliative care, surgical excision, and, when necessary,humane euthanasia may be elected. Neoplasia must be distinguished from common infectious, nonneoplastic conditions that can negatively impact population health. This article is a review of the more common types of neoplasia in amphibians, and includes clinically relevant information, such as biologic behavior,anatomy, associated etiologies, major differential diagnoses, and clinical management.
Descriptors: amphibians, neoplasia, tumors, differential diagnosis, viral infection, anatomy, clinical management, surgical excision, palliative care.

Sykes, J.M. and C.B. Greenacre (2006). **Techniques for drug delivery in reptiles and amphibians.** *Journal of Exotic Pet Medicine* 15(3): 210-217. ISSN: 1557-5063.
NAL Call Number: SF994.2.A1 S36
Descriptors: amphibians, reptilies, techniques for drug delivery, treatment.

Tarigo, J., K. Linder, J. Neel, S. Harvey, A. Remick, and C. Grindem (2006). **Reluctant to dive: coelomic effusion in a frog.** *Veterinary Clinical Pathology* 35(3): 341-344. ISSN: 0275-6382.
NAL Call Number: SF601.A54
Abstract: An adult female, albino South African Clawed frog (*Xenopus laevis*) from a research colony at the Biological Resources Facility of the College of Agriculture and Life Sciences at North Carolina State University (NCSU) was presented with depression, lethargy, loss of diving reflex, and a distended abdomen. Cytologic examination of coelomic effusion fluid at the NCSU veterinary teaching hospital revealed a mixed population of inflammatory cells, including heterophils and a predominance of large mononuclear cells (macrophages)

that often contained intracytoplasmic, negatively-stained, rod-shaped to filamentous organisms consistent with Mycobacterium sp. Ziehl-Neelsen stain revealed bright pink to red, acid-fast organisms with a beaded appearance. Histopathologic findings in tissues obtained at necropsy included marked, multifocal to coalescing, heterophilic, granulomatous and fibrinous coelomitis as well as severe multifocal heterophilic and granulomatous hepatitis, interstitial pneumonia and sinusitis/rhinitis. Slender gram-positive, acid-fast bacterial rods were identified in sections of coelomic pleura, kidneys, nasal cavities, spleen, liver, and pulmonary interstitium, indicative of systemic mycobacteriosis. Based on mycobacterial culture, the organism was identified as *M marinum* complex. Mycobacteria are variably gram-positive, often acid-fast, small rods that are ubiquitous in aquatic environments. The clinical and pathologic spectrum of disease in amphibians depends on host and pathogen status. *Xenopus* sp and several other frogs are good models for studying the pathogenesis of *M tuberculosis* infection. In addition to culture, polymerase chain reaction assays may be used for definitive identification of the organisms; accurate speciation may require further genetic investigation.
Descriptors: frog, *Xenopus laevis*, mycobacterium infections, atypical infection, veterinary, *Mycobacterium marinum* isolation and purification, *Xenopus laevis* microbiology, fatal outcome, atypical diagnosis, atypical pathology, polymerase chain reaction veterinary, staining and labeling methods.

Trott, K.A., B.A. Stacy, B.D. Lifland, H.E. Diggs, R.M. Harland, M.K. Khokha, T.C. Grammer, and J.M. Parker (2004). **Characterization of a *Mycobacterium ulcerans*-like infection in a colony of African tropical clawed frogs (*Xenopus tropicalis*).** *Comparative Medicine* 54(3): 309-317. ISSN: 1532-0820.
NAL Call Number: SF77.C65
Abstract: A nontuberculous *Mycobacterium ulcerans*-like organism was identified as the causative agent of an epizootic of mycobacteriosis in a colony of African tropical clawed frogs, *Xenopus (Silurana) tropicalis*, at the University of California, Berkeley. Diverse clinical signs of disease were observed, including lethargy, excess buoyancy, coelomic effusion, cutaneous ulcers, and granulomas. Visceral granulomas, ulcerative and granulomatous dermatitis, coelomitis, and septicemia were common findings at necropsy. Identification of *M. ulcerans*-like organisms was based on molecular and phenotypical characteristics. The findings of this investigation indicate that this *M. ulcerans*-like organism is a primary cause of morbidity and mortality in aquatic anurans and should be considered in the differential diagnosis of coelomic effusion in amphibians. Furthermore, if this Mycobacterium species ultimately is identified as *M. ulcerans*, *X. tropicalis* should be considered a potential source of this important public health pathogen.
Descriptors: amphibians, African tropicalclawed frogs, mycobacterium infections, atypical diagnosis, *Mycobacterium ulcerans* genetics, isolation, purification, *Xenopus* microbiology, liver microbiology, pathology, atypical pathology, differential diagnosis.

Tuttle, A.D., J.M. Law, C.A. Harms, G.A. Lewbart, and S.B. Harvey (2006). **Evaluation of the gross and histologic reactions to five commonly used suture materials in the skin of the African clawed frog (*Xenopus laevis*).** *Journal of the American Association for Laboratory Animal Science* 45(6): 22-26. ISSN: 1559-6109.

Online: http://www.aalas.org
NAL Call Number: SF405.3.A23
Descriptors: African clawed frog, *Xenopus laevis*, suture materials evaluation, gross, histologic, reactions, five commonly used, nylon, oedema, oocytes, silk, skin, surgery, surgical equipment , .

Uteshev, V.K., T.N. Pashovkin, A.N. Sevirov, E.V. Mel'nikova, D.G. Sadikova, V.N. Karnaukhov, and E.N. Gakhova (2006). **[Survival of amphibian embryos after continuous ultrasound treatment]**. *Biofizika* 51(3): 539-544. ISSN: 0006-3029.
Abstract: The influence of continuous ultrasound on the embryonic development of grass frog *Rana temporaria* has been investigated. Intact embryos at the blastula stage were treated by ultrasound of different frequency (0.88 and 2.64 MHz), intensity (0.05-1.0 W/cm2), and duration (1-15 min). The treatment with ultrasound of frequency 0.88 MHz and intensity 0.05 W/cm2 for 1-5 min tended to increase the proportion of normally developing embryos up to hatch (10-25% of control). Increasing the intensity of ultrasound (0.88 MHz) to 0.7-1.0 W/cm2 and the duration of its action to 5-15 min induced the death of almost all of treated embryos. No significant differences were found between the development of control embryos and embryos treated with ultrasound of middle intensity (0.2-0.7 W/cm2) for 1-5 min. The exposure of amphibian embryos to ultrasound of frequency 2.64 MHz and intensity 0.05-0.7 W/cm2 for 1-5 min did not change their survival. Increasing the intensity of ultrasound (2.64 MHz) to 1.0 W/cm2 and the duration of its action to 5 min decreased the number of normal developing embryos (by 35%).
Descriptors: *Rana temporaria* embryology, ultrasonics adverse effects, blastula physiology, embryo, nonmammalian physiology, embryonic development, time factors.
Language of Text: Russian.

Webb, R., D. Mendez, L. Berger, and R. Speare (2007). **Additional disinfectants effective against the amphibian chytrid fungus *Batrachochytrium dendrobatidis.*** *Diseases of Aquatic Organisms* 74(1): 13-16. ISSN: print: 0177-5103; online: 1616-1580.
Online: http://dx.doi.org/10.3354/dao074013
Abstract: Chytridiomycosis, a disease contributing to amphibian declines worldwide, is caused by the fungus *Batrachochytrium dendrobatidis*. Identifying efficient and practical disinfectants effective against *B. dendrobatidis* is important to reduce the spread of the disease both in the wild and captivity. Previous studies identified a range of suitable disinfectant strategies. We evaluated the suitability of 3 additional disinfectants: two of these (TriGene Virucidal Disinfectant Cleaner and F10 Super Concentrate Disinfectant) are mixtures of chemicals and one (Betadine Antiseptic Liquid) contains a single active ingredient, povidone iodine. The disinfectants were tested using a range of concentrations for 1,5 and 10 min to determine their ability to kill *B. dendrobatidis* in vitro. The measure of effectiveness was 100% kill of zoosporangia grown in multiwell plates. All disinfectants had a 100% efficacy at concentrations recommended by the manufacturers. The lowest concentrations capable of 100% kill after exposure for 1 min were 0.1 ml l(-1) for TriGene, 0.33 ml l(-1) for F10 and 100 ml l(-1) for Betadine. TriGene is the most effective disinfectant yet to be found, and both TriGene and F10 are more effective than various disinfectants tested in previous studies.

TriGene and F10 are considered suitable for use in the field, as only small amounts of concentrate are needed.
Descriptors: decline of amphibians, chytrid fungus, *Batrachochytrium dendrobatidis*, effective disinfectants, chytridomycosis, disinfectant strategies, reduce spread, kill of zoosporangia, lowest concentrations, TriGene most effective.

Weldon, C. and L.H. Du Preez (2006). **Quantitative measurement of *Batrachochytrium dendrobatidis* in amphibian skin**. *Diseases of Aquatic Organisms* 72(2): 153-161. ISSN: 0177-5103.
Online: http://dx.doi.org/10.3354/dao072153
Descriptors: amphibians, disease, skin, *Batrachytrium dendrobatidis*, quantitative measurement, pathological research, skin sloughs, examination.

Wright, K. (2003). **Cholesterol, corneal lipidosis, and xanthomatosis in amphibians.** *Veterinary Clinics of North America, Exotic Animal Practice* 6(1): 155-167. ISSN: 1094-9194.
NAL Call Number: SF997.5.E95 E97
Abstract: Many captive amphibians have high serum or plasma cholesterol and concomittant lesions such as corneal lipidosis and xanthomas. The underlying cause of this disorder is unknown, but it is likely that a diet high in cholesterol plays a role. The metabolism of lipids in healthy amphibians remains poorly documented, which makes it challenging to interpret the findings in affected specimens. Affected amphibians should be maintained on a low-cholesterol diet and fed sparingly, and their captive environment modified to provide an optimal temperature gradient for thermoregulation.
Descriptors: amphibians, corneal lipidosis, xanthomatosis, cholesterol, captive, diet, low cholesterol, thermoreglation.

Wright, K. (2006). **Veterinary advances that impact amphibian conservation**. *Small Animal and Exotics Proceedings of the North American Veterinary Conference.* 20: 1783-1785. ISSN: 0003-1488.
Online: http://www.tnavc.org
Descriptors: amphibians, veterinary advances, drugs, treatment, conservation, diagnosis, conference proceedings.

Wright, K. (2006). **Common medical problems of amphibians**. *Small Animal and Exotics Proceedings of the North American Veterinary Conference.* 20: 1689-1691. ISSN: 0003-1488.
Online: http://www.tnavc.org
Descriptors: amphibians, common medical problems, exotics, veterinary conference.

Wright, K. (2006). **Important clinical aspects of amphibian physiology**. *Small Animal and Exotics Proceedings of the North American Veterinary Conference.* 20: 1686-1688. ISSN: 0003-1488.
Online: http://www.tnavc.org
Descriptors: anatomy, animal physiology, body temperature, calcium, dehydration, energy metabolism, exotics, homeostasis, morphology, pets, rehydration, amphibians, clinical aspects.

Notes: Meeting Information: The North American Veterinary Conference, Gainesville, USA, Orlando, Florida, USA. January 7-11, 2006.

Wright, K. (2005). **Advances that impact every amphibian patient.** *Exotic DVM* 7(3): 82-86. ISSN: 1521-1363.
NAL Call Number: SF981.E96
Descriptors: amphibian patient, advances, impact.

Xie Jian, Li Zheng Qiu, Zhang Qi Ya, and Li Wen Xin (2002). **Detection of *Rana grylio* virus (rgv) in host frog tissues by using immunohistochemistry assay**. *Acta Hydrobiologica Sinica* 26(5): 438-443. ISSN: 1000-3207.
NAL Call Number: QH540
Descriptors: amphibians, frogs, *Rana grylio* virus, infection, detection, frog tissues, immunohistochemistry assay, heart, lung, spleen, liver, RGV.
Language of Text: Chinese.

Zaias, J. and C. Cray (2002). **Protein electrophoresis: a tool for the reptilian and amphibian practitioner.** *Journal of Herpetological Medicine and Surgery* 12(1): 30-32. ISSN: 1529-9651.
NAL Call Number: SF997.5.R4 B85
Descriptors: amphibians, reptiles, diagnostic techniques, protein electrophoresis, diagnostic potential, veterinary care.

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.

AmphibiaWeb.
Online: http://amphibiaweb.org/index.html
Description: Provides information relating to amphibian biology and conservation in a free online searchable format.

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.

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.

Zoos Play a Vital Role in Amphibian Conservation. *Kevin Zippel*.
Online: http://amphibiaweb.org/declines/zoo/index.html
Description: This document on AmphibiaWeb summarizes the ways in which zoos are striving and struggling to meet the needs of amphibians and aims to further zoo/academia collaborations.

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.

Bibliography of Pain and Analgesia in Herps. *Melissa Kaplan*.
Online: http://www.anapsid.org/herppainbiblio.html
Description: This bibliography was last updated in 2007.

The Frog and Toad as Experimental Animals (PDF, 3MB). *Michael J. Tyler*.
Online: http://www.adelaide.edu.au/ANZCCART/publications/FrogsandToad_8.pdf
Description: Information on housing, environmental conditions, euthanasia, breeding, blood collection, marking, drug administration, diseases, and parasites of frogs and toads in research environments.

Guidance on the Housing and Care of the African Clawed Frog, Xenopus laevis (2005). *Royal Society for the Prevention of Cruelty to Animals. Research Animals Department.*
Online: http://www.rspca.org.uk/servlet/Satellite?pagename=RSPCA/RSPCARedirect&pg=xenopus
Description: A report on how husbandry and procedures can be refined to reduce suffering and improve welfare of Xenopus laevis frogs.

Boreal Toad Husbandry Manual (PDF, 1.91 MB). *Scherff-Norris, K.L., L.J. Livo, A. Pessier, C. Fetkavich, M. Jones, M. Kombert, A. Goebel, and B. Spencer*. *Colorado Division of Wildlife*.
Online: http://wildlife.state.co.us/NR/rdonlyres/23912565-3F5F-4026-A4C3-BD34C29BB564/0/FinalHatcheryManual122402.pdf
Description: Provides information on rearing and propagating boreal toads (*Bufo boreas boreas*) in captivity. These toads are used for reintroductions and 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

FrogWeb: Amphibian Declines & Malformations . *USGS. Center for Biological Informatics. National Biological Information Infrastructure.*
Online: http://frogweb.nbii.gov/index.html
Description: Provides information on the geography and natural history of amphibians in North America. Includes a link to the North American Reporting Center for Amphibian Malformations (NARCAM) - http://frogweb.nbii.gov/narcam/.

Amphibian Care Sheet and Information. *Western New York Herpetological Society.*
Online: http://www.wnyherp.org/care-sheets/amphibians/
Description: Provides care sheets for amphibians, including frogs, toads, newts, and salamanders. Sheets contain information on housing, nutrition, and enclosure maintenance requirements.