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Selected Animal Welfare Issues

- The Science of Animal Well-being
  (links to the article previously published in the Animal Welfare Information Center Newsletter)
- Arguments for Single-caging of Rhesus Macaques: Are They Justified?
  (links to the article previously published in the Animal Welfare Information Center Newsletter)
- Adoption of Research Animals
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Oocyte Harvesting in Xenopus laevis

This guideline was revised and approved by the National Institutes of Health Animal Research Advisory Committee on February 10, 1999 and is available at http://oacu.od.nih.gov/ARAC/documents/Oocyte_Harvest.pdf

Amphibian oocytes are used for studies in molecular biology, embryology and biochemistry. Stage I-VI oocytes are obtained by surgical laparotomy. Multiple surgeries on a single animal may be justified considering the reduction in the total number of animals used over the long term. However, the total number of animals used must be considered relative to the pain or distress experienced by an individual animal.

1.The total number of laparotomies should be limited and will depend on the condition of the animal and quality of the oocytes as well as the life span of the animal and the duration of egg production. Up to five recovery surgeries (the 6th would be terminal) per animal are acceptable. Additional survival surgeries should have approval of the individual ACUC.

2.Surgeries should be performed by trained personnel using appropriate anesthesia such as tricaine methane-sulfonate (MS-222). Surgeries should be done as aseptically as practical including the use of sterilized instruments and gloves.

3.Single housing or small group housing for several days after surgery should be considered as part of the post surgical care of laparotomized animals. Frogs should be monitored daily during this period for appetite as well as for any complications such as dehiscence or infection. Such adverse effects would be reasons for immediate euthanasia.

4.Adequate recovery time should be allowed between laparotomies. The investigator can alternate oocyte collection between left and right ovaries and consider rotation of frogs so that the interval between surgeries in any individual is maximized. Recovery time of less than one month should have approval of the individual ACUC.

Animal Welfare Issues Bibliography

Anderson, D. L. (1993). ***Handbook of Live Animal Transport.***
NAL call number: HV4733.H36 1993
Descriptors: Animal welfare, animal handling and safety, veterinary procedures, animal health regulations, transporting animals by land, sea and air, exporting animals.

Benn, D.M. (1995). **Innovations in research animal care.** *Journal of the American Veterinary Medical Association* 206(4): 465-468.
NAL call number: 41.8 AM3
Descriptors: animal experiments, laboratory animals, animal welfare.

Beynen A.C. (1992). **Communication between rats of experiment-induced stress and its impact on experimental results.** *Animal Welfare* 1(3): 153-159.
NAL call number: HV4701 A557
Descriptors: animal experiments, laboratory animals, stress, communication between animals.

Bollen, P., A. Andersen, and L. Ellegaard (1998). **The behaviour and housing requirements of minipigs.** *Scandinavian Journal of Laboratory Animal Science* 25(SUPP 1): 23-26.
NAL call number: QL55 S322
Descriptors: animal behavior; pig housing; housing requirements; miniature pigs.

Bosland, M.C. (1995). **Is decapitation a humane method of euthanasia in rodents? A critical review.** *Contemporary Topics in Laboratory Animal Science* 34 (2): 46-48.
NAL call number: SF405.5.A23
Descriptors: rodents, decapitation, euthanasia, animal welfare.

Broderson, J.R. (1989). **A retrospective review of lesions associated with the use of Freund's adjuvant.** *Laboratory Animal Science* 39(5): 400-405.
NAL call number: 410.9 P94
Abstract: A retrospective evaluation was made of lesions observed after the use of Freund's adjuvant formulations in rabbits and monkeys. Inflammation was consistently present at the sites of inoculation. Complications frequently included focal necrosis and ulceration of the skin. Other lesions included fistulous tracts, self-induced trauma, muscle atrophy, hypersensitivity pneumonitis, and embolic pneumonia. Lesions were most severe with formulations containing larger quantities of mycobacteria or with larger volumes of adjuvant injected per site.
Descriptors: adverse effects, adjuvants, Freund's, polyclonal antibody production, vaccine trials, rabbits, Aotus monkeys.

Broom, D.M. (1998). **Psychological indicators of stress and welfare.** In *Ethics, welfare, law and market forces: the veterinary interface. Proceedings of a Symposium, Royal College of Veterinary Surgeons, UK, 14-15th November 1996,* A.R. Michell and R. Ewbank, (eds.), Wheathampstead, UK: Universities Federation for Animal Welfare (UFAW), p.167-175.
NAL call number: HV4704 E84 1998
Descriptors: stress, animal welfare, behavior.

Broom, D.M. (1993). **A usable definition of animal welfare.** *Journal of Agricultural & Environmental Ethics* 6 (special suppl.2): 15-25.
NAL call number: BJ52.5.J68
Descriptors: animal welfare, animal production, stress, pain, abnormal behavior, livestock.

Casebolt, D.B., D.J. Speare, and B.S. Horney (1998). **Care and use of fish as laboratory animals: current state of knowledge.** *Laboratory Animal Science* 48(2): 124-136.
NAL call number: 410.9 P94
Descriptors: transgenic animals, animal housing, water quality, fish diseases, environmental factors, stress, fishes.

Danneman, P.J., S. Stein, and S.O. Walshaw (1997). **Humane and practical implications of using carbon dioxide mixed with oxygen for anesthesia or euthanasia of rats.** *Laboratory Animal Science* 47(4): 376-385.
NAL call number: 410.9 P94
Abstract: A series of studies was undertaken to determine whether CO2 can be used as a humane as well as practical agent for euthanasia or anesthesia of rats. Human volunteers rated the degree of discomfort associated with breathing 50 to 100% CO2 mixed with oxygen. Increasing concentrations of CO2 were judged as progressively more noxious, from "highly unpleasant" for 50% CO2 to "painful" for 100% CO2. The practical aspects of anesthesia and euthanasia with 50 to 100% CO2 were studied, using male Sprague Dawley rats. Time to anesthesia and death were inversely related to CO2 concentration, as were the frequency and severity of adverse reactions, including seizures and hemorrhaging from the nose. The severity of edema and hemorrhage, which were observed on histologic examination of the lungs of all rats euthanized with CO2, were greatest in the animals exposed to the lowest concentrations. There were no significant effects of CO2 concentration on time to recumbency or recovery, and there were no significant effects of precharging versus not precharging the chamber on any of the parameters studied. It was concluded that, although CO2 can be used in a humane manner, the concentrations that are least likely to cause pain and distress are associated with the longest times to anesthesia and death, highest incidence of unwanted side effects, and most severe histologic changes in the lungs. Acceptably humane and reasonably practical euthanasia or anesthesia can be achieved using a nonprecharged chamber and a low gas flow rate so that conscious animals are never exposed to CO2 concentrations >70%.

Doris, P.A. (1989). **Humane principles and procedures in animal research. Animal research training series.** *Texas Tech University Health Science Center*, 1 videocassette (30 min.)
NAL call number: Videocassette (2 copies) - nos. 804 and 805
Descriptors: new legal requirements, ACUC, husbandry.

Dreesen, R.G. (1987).**Considerations in the humane use of laboratory animals in radiology research.** *Radiologic Technology* 58(4): 347-350.
Descriptors: animal welfare, laboratory animals, radiology, research methods, committee requirements, ACUC.

Foltz, C.J. and M. Ullman-Cullere (1999). **Guidelines for assessing the health and condition of mice.** *Lab Animal* 28(4): 28-32.
NAL call number: QL55 A1L33
Descriptors: transgenic mice, knockout mice, potentially debilitating phenotypes, humane endpoints, monitoring criteria, communications between veterinary staff and investigators, body condition scoring, health guidelines, barbering, fighting, malocclusion, rectal prolapse, tumors and masses, ulcerative dermatitis, vaginal or uterine prolapse, subtle health problems--activity/behavior, anemia, dehydration, diarrhea, hypothermia, preputial or vaginal discharge, additional health problems--abnormal breathing, abnormal locomotion, eye abnormality, head tilt, hyperactivity, lethargy, paresis, paralysis, ruffled fur, tremors.

Guttman, H.N., J.S. Mench, and R.C. Simmonds (eds.) (1988). ***Science and Animals: Addressing Contemporary Issues: From a Conference Held by the Scientists Center for Animal Welfare in Washington, DC on June 22-25,1988.***
NAL call number: HV4704 S33 1988
Descriptors: industrial IACUC's, ethics, environmental conditions, laboratory animals, farm animals, aversive stimuli, feed deprivation, water deprivation, adjuvants, non-affiliated member of the IACUC.

Hammond, A.C. (1994). **Animal well-being in pharmacology and toxicology research.** *Journal of Animal Science* 72 (2): 523-527.
NAL call number: 49 J82
Abstract: The primary objective of this paper is to heighten the awareness of animal welfare issues among animal scientists. Emphasis is placed on issues relating to pharmacology and toxicology research with animals. Use of both laboratory animals and farm animals is addressed; major consideration is given to domestic livestock. Animal welfare issues are complex and have philosophical, ethical, legal, societal, scientific, and biological bases and implications. There is substantial diversity in public opinion and perception regarding use of animals in research, including the belief

among some people that use of animals in research should be eliminated altogether. Increasingly, public opinion is tending toward expectations of alternatives to the use of live animals for research. From an animal scientist's viewpoint, although the availability and development of viable alternatives are increasing, live animal research in pharmacology and toxicology currently has no acceptable alternative, in many cases because of the complex interactions involved in whole-animal (biological) systems. Compliance with federal, state, and local laws, regulations, and policies requires animal scientists to use only appropriate species for research, use the minimum number of animals needed, minimize pain and discomfort, and consider alternatives to the use of live animals. In summary, it is essential that animal scientists be advocates of animal well-being and adhere to appropriate guidelines for animal care and use when conducting research with animals.
Descriptors: laboratory animals, livestock, animal experiments, animal welfare, pharmacology, toxicology.

Hawkins, P. (1999). **Working together to improve rodent well-being.** *Lab Animal* 28(2):30-32.
NAL call number: QL55A1L33
Abstract: The UK has seen a productive relationship between animal welfare and research interests. This has culminated in the formation of the Royal Society for the Prevention of Cruelty to Animals/Universities Federation for Animal Welfare (RSPCA/UFAW) Rodent Welfare Group, in which technicians, researchers, veterinarians, and animal advocates share information and experience. The author provides some highlights from recent group meetings.

Hem, A., A.J. Smith, and P. Solberg (1998). **Saphenous vein puncture for blood sampling of the mouse, rat, hamster, gerbil, guinea pig, ferret and mink.** *Laboratory Animals* 32(4): 364-368.
NAL call number: QL55 A1L3
Descriptors: alternatives (to retroorbital bleeding), blood sampling techniques, laboratory animals, blood specimen collection, animal welfare.

Hendriksen, C.F.M. and W. de Leeuw (1998). **Production of monoclonal antibodies by the ascites method in laboratory animals.** *Research in Immunology* 149(6): 535-542.
NAL call number: QR180 A5
Descriptors: ascites, monoclonal antibodies, animal welfare, animal testing alternatives, production methods.

Herck, H. van, V. Baumans, C.J.W. Brandt, A.P.M. Hesp, J.H. Sturkenboom, H.A. van Lith, G. van Tintelen, and A.C. Beynen (1998). **Orbital sinus blood sampling in rats as performed by different animal technicians: The influence of technique and expertise.** *Laboratory Animals* 32 (4): 377-386.
NAL call number: QL55 A1L3
Descriptors: clinical signs, Pasteur pipette or a haematocrit capillary, lateral vs medial canthus of the orbit.

Herck, H. van, V. Baumans, N.R. van der Craats, A.P.M. Hesp, G.W. Meijer, G. van Tintelen, H.C. Walvoort, and A.C. Beynan (1992). **Histological changes in the orbital region of rats after orbital puncture.** *Laboratory Animals* 26(1): 53-58.
NAL call number: QL55 A1L3
Descriptors: retroorbital bleeding, pasteur pipette, capillary tube, hemorrhage in puncture track and periosteum, inflammation present four days after procedure in puncture track, eye muscles, periosteum and Harderian gland, no lesions detected at 28 days post-procedure, differences between techniques and technicians.

Institute of Laboratory Animal Resources (1996). ***The Psychological well-being of nonhuman primates.*** Washington, DC: National Academy Press, 168 p. Full-text document is available at
http://www.nap.edu/books/0309052335/html/index.html
NAL call number: QL737 P9 P776 1998
Descriptors: essentials of a program to provide psychological well-being, general care, effect of special research conditions, prosimians, new world monkeys, old world monkeys, apes, research needs.

Institute of Laboratory Animal Resources (1996). ***Laboratory Animal Management Series: Rodents.*** Washington, DC: National Academy Press, 167 p.
Descriptors: rats, mice, gerbils, hamsters, guinea pigs, laboratory animal management, animal husbandry, veterinary care, animal facilities, animal care.

Jackson, L.R. and J.G. Fox (1995). **Institutional policies and guidelines on adjuvants and antibody production.** *ILAR Journal* 37(3): 141-152.
NAL call number: QL55 A1I43
Descriptors: monoclonal antibody production, selection of animals, immunization protocols, priming agents, inoculation of hybridoma cells, abdominal paracentesis, clinical observations, alternatives, polyclonal antibody production, antigen preparation, antigen-adjuvant emulsions, routes, volumes, and sites of administration, post-injection observations, blood collection, restraint, institutional resources, personnel safety.

Jackson, LR., L.J. Trudel, J.G. Fox, and N.S. Lipman (1999). **Monoclonal antibody production in murine ascites. I. Clinical and pathologic features.** *Laboratory Animal Science* 49(1): 70-80.
NAL call number: 410.9 P94
Abstract: BACKGROUND AND PURPOSE: Murine ascites production has been associated with appreciable morbidity and mortality, thus raising animal-welfare concerns. To address these concerns, the clinicopathologic changes associated with in vivo production of monoclonal antibodies in mice were characterized, and results were compared among cell lines. METHODS: Five hybridoma cell lines were grown in groups of 20 mice. Fourteen days prior to inoculation with 10(6) hybridoma cells, mice were primed with 0.5 ml of pristane given intraperitoneally; 12 mice were sham treated (controls). Ascites fluid was collected a maximum of three times by abdominal paracentesis. Clinical observations and pre- and postabdominal tap body weights were recorded. Necropsies were performed on all mice. RESULTS: For all groups combined, overall survival to tap 1 was 98%, to tap 2 was 96%, and to tap 3 was 79%; survival among groups ranged from 90 to 100% for tap 1, 85 to 100% for tap 2, and 35 to 100% for tap 3. Disseminated intra-abdominal seeding with irregular soft tissue and/or solid tumor masses was observed at necropsy. CONCLUSIONS: Significant clinicopathologic changes were associated with monoclonal antibody production in mice, and differences between various hybridoma cell lines were apparent.

Jennings, M, G.R. Batchelor, P.F. Brain, A. Dick, H. Elliot, R.J. Francis, R.C. Hubrecht, J.L. Hurst, D.B. Morton, A.G. Peters, R. Raymond, G.D. Sales, C.M. Sherwin, and C. West (1998). **Refining rodent husbandry: the mouse. Report of the rodent refinement working party.** *Laboratory Animals* 32(3): 233-259.
NAL call number: QL55 A1L3
Descriptors: animal-husbandry, animal welfare, animal housing, cages, hygiene.

Ladewig, J. **Behavior of laboratory animals under unnatural conditions.** *Archives of Toxicology* 20(suppl): 41-46.
NAL call number: RA1190 A7
Abstract: Domestic animals are animals whose living conditions and reproduction, among other things, are controlled by man. As such, the current discussion about the welfare of domestic animals is similar for farm, companion, laboratory, and zoo animals. It concerns identification of the behavioral and physiological needs of the animals and development of living conditions that enable them to satisfy these needs. The paper describes two approaches that have been used in behavior biology to identify such needs. One approach is the measurement of stress responses that may be activated when an animal's needs are not fulfilled. The other approach is the use of operant conditioning techniques to establish demand functions by which the motivation of an animal to perform a specific behavior is measured. It is concluded that, since welfare is characterized by the absence of a number of factors, such as stress, pain, fear, disease, hunger etc., many types of measurements must be applied to ensure optimal welfare.
Descriptors: animal welfare, animal psychology, behavior, laboratory animal science.

Leenaars, P.P.A.M., M.A. Koedam, P.W. Wester, V. Baumans, E. Claassen, and C.F.M. Hendriksen (1998). **Assessment of side effects induced by injection of different adjuvant/antigen combinations in rabbits and mice.** *Laboratory Animals* 32(4): 387-406.
NAL call number: QL55 A1L3
Abstract: We evaluated the side effects induced by injection of Freund's adjuvant (FA) and alternative adjuvants combined with different antigens. Rabbits and mice were injected subcutaneously, intramuscularly (rabbits) and intraperitoneally (mice) with different adjuvants (FA, Specol, RIBI, TiterMax, Montanide ISA50) in combination with several types of antigens (synthetic peptides, autoantigen, glycolipid, protein, mycoplasma or viruses). The effects of treatment on the animals' well-being were assessed by clinical and behavioural changes (POT and LABORAS assays) and gross and histopathological changes. In rabbits, treatment did not appear to induce acute or prolonged pain and distress. Mice showed behavioural changes immediately after (predominantly secondary) immunization. Injection of

several adjuvant/antigen mixtures resulted in severe pathological changes, depending on adjuvant, type of antigen, animal species used and route of injection. Both rabbits and mice showed pathological changes ranging from marked to severe after injection of FA, and ranging from minimal to marked after Specol and Montanide injections. Pathological changes after RIBI injections were severe in rabbits, though slight in mice. After TiterMax injections, pathological changes were moderate in rabbits, though severe in mice. In conclusion, injection of FA according to present guidelines resulted mostly in severe pathological changes, whereas only very few clinical and behavioural signs indicated prolonged severe pain. Our findings indicate that Montanide ISA50 and Specol induce acceptable antibody titres, and cause fewer pathological changes than FA. Thus they are effective alternatives to FA.

Marbrook, J. (1998). **Transgenesis and animals in research - an overview of animal welfare considerations.** *Surveillance* (Wellington, New Zealand) 25(2): 12-14.
NAL call number: SF604.63 N45S87
Descriptors: laboratory animals, animal welfare, genetics, transgenic animals.

Markowitz, H. and A. Gavazzi (1995). **Eleven principles for improving the quality of captive animal life.** *Lab Animal* 24(4): 30-33.
NAL call number: QL55 A1L33
Descriptors: ability to collect or gather food, varying food availability periodically, novelty, control of environment, socialization, continuing assessment of animals in their cages, animal caretaker interaction.

Martin, B.J. (1995). **Evaluation of hypothermia for anesthesia in reptiles and amphibians.** *ILAR Journal* 37(4): 186-190.
NAL call number: QL55 A1I43
Descriptors: research and regulatory guidelines, IACUC evaluation of hypothermia as an appropriate method, review of scientific literature, physiological changes<, pathological changes, literature does not support the use of hypothermia as a clinically efficacious method of anesthesia.

McIntosh, J. and E.C. Staley (1989). **Limits of food and water deprivation.** In *Science and Animals: Addressing Contemporary Issues* H.N. Guttman, J.A. Mench, and R.C. Simmonds (eds.), Bethesda, Maryland: Scientists Center for Animal Welfare, p. 117.
NAL call number: HV4704.S33 1989
Descriptors: protocol, food/water intake, controlled feeding, monitoring of animals.

Meer, M. van der, V. Baumans, and L.F.M. van Zutphen (1996). **Transgenic animals: What about their well-being?** *Scandanavian Journal of Laboratory Animal Science* 23(Suppl.1): 287-290.
NAL call number: QL55 S322
Descriptors: welfare problems may arise at many different levels-- experimental procedures used to introduce DNA constucts, integration of microinjected DNA into the genome is unpredictable and may cause unintended insertional mutations, review of research.

Moberg, G.P. (1999). **When does stress become distress?** *Lab Animal* 28(4): 22-26.
NAL call number: QL55 A1L33
Descriptors: defining stress and distress in laboratory animals, stress model, perception of the stressor, biological defense, measuring stress reaction, recognizing changes in biological function, prepathological state, cumulative cost of multiple stressors, summated stressors, managing stress and distress.

Moore, C.J. and T.B. Mepham (1995). **Transgenesis and animal welfare.** *Alternatives to laboratory animals: ATLA* 23 (3):380-397.
NAL call number: Z7994 L3A5
Abstract: The two main techniques used in biomedical research for the production of transgenic animals have several implications for animal welfare in terms of the Three Rs of Russell & Burch. Some are intrinsic to the transgenic objectives, while others relate to the effects of mutations, transgene expression, associated methodologies, and husbandry or production systems. All of these actual and potential implications for animal welfare demand serious consideration within a broad ethical analysis of the technology. In the light of the Three Rs, this may require a

fundamental reappraisal of the processes by which such scientific procedures are approved.
Descriptors: transgenic animals, gene transfer, domestic animals, animal welfare, laboratory animals, animal models, genetic effects, literature reviews.

Morton, D.B. (1998). **Perceived and actual welfare issues - laboratory animals.** In *Ethics, welfare, law and market forces: the veterinary interface. Proceedings of a Symposium, Royal College of Veterinary Surgeons, UK, 14-15th November 1996,* A.R. Michell and R. Ewbank, (eds.), Wheathampstead, UK: Universities Federation for Animal Welfare (UFAW), p. 91-106.
NAL call number: HV4704 E84 1998
Descriptors: animal welfare; laboratory animals

Niemi, S.M., J.S. Venable, and H.N. Guttman (eds.) (1994). ***Rodents and Rabbits, Current Research Issues: Proceedings of a Conference Sponsored by Scientists Center for Animal Welfare (SCAW) and Working with An imals Used in Research, Drugs, and Surgery (WARDS) held in Washington, D.C. on May 21, 1993.*** SCAW: Greenbelt, MD and WARDS: Fairfax, VA, 81 p.
NAL call number: SF407.R6R63 1994.
Contents: Request for changes in USDA regulations by Martin L. Stephens -- Recognizing stress in rodents and rabbits by Gerald F. Gebhart -- Enrichment techniques for rodents and rabbits by David Morton -- Transgenic rodents by Terrie Cunliffe-Beamer -- Anesthesia, analgesia for rodents and rabbits by Sally K. Wixson -- Aseptic surgery for rodents by Marilyn J. Brown -- Adjuvant comparison in rabbits by David K. Johnson.
Descriptors: rodents as laboratory animals, rabbits as laboratory animals, animal experimentation, animal welfare.

Niemi, S. (1989). **Use of immune stimulants.** In *Science and Animals: Addressing Contemporary Issues* H.N. Guttman, J.A. Mench, and R.C. Simmonds (eds.), Bethesda, Maryland: Scientists Center for Animal Welfare, pp. 119-121.
NAL call number: HV4704.S33 1988
Descriptors: adjuvant, ACUC, laboratory animals, ascites.

Oestermann, D.J., J.M. Scimerca, J. Forsythe, R. Hanlon, and P. Lee (1997). **Special considerations for keeping cephalopods in laboratory facilities.** *Contemporary Topics in Laboratory Animal Science* 36(2): 89-93.
NAL call number: SF405.5 A23
Descriptors: biology and life history, basic tank and sea water system requirements, receiving and post-shipment handling, feeding, common health problems, health monitoring and treatment, postmortem evaluation.

Poole, T.B. (1995). **Guidelines and legal codes for the welfare of non-human primates in biomedical research.** *Laboratory Animals* 29(3): 244-9.
NAL call number: QL55.A1L3.
Descriptors: animal husbandry, animal welfare, housing, physiology, legislation, behavior, Canada, Europe, Great Britain, United States.

Poole, T. (1997). **Happy animals make good science.** *Laboratory Animals* 31(2): 116-124.
NAL call number: QL55.A1L3.
Abstract: In this paper the question is posed whether it is not only better for the animal to he happy, but whether its state of mind may also have the potential to influence the scientific results derived from it. To ensure good science, the animal should have a normal physiology and behaviour, apart from specific adverse effects under investigation. There is a growing body of evidence from a wide variety of sources to show that animals whose well-being is compromised are often physiologically and immunologically abnormal and that experiments using them may reach unreliable conclusions. On scientific, as well as ethical grounds, therefore, the psychological well-being of laboratory animals should he an important concern for veterinarians, animal technicians and scientists.
Descriptors: laboratory animals, animal welfare, immune response, handling.

Preparation and Maintenance of Higher Mammals During Neuroscience Experiments. Report of a National Institutes of Health Workshop, March 1991. Bethesda, Maryland: DHHS, Public Health Service, National Institutes of Health, 45 p.
NAL call number: HV4930 P74

Descriptors: prolonged non-survival recording procedures, survival anatomical procedures, perinatal procedures, inducing neurological deficits, awake behaving preparations, animal care and use concerns, sample research protocols.

Reinhardt, V. (1997). **Training nonhuman primates to cooperate during handling procedures: a review.** *Animal Technology* 48(2): 55-73.
NAL call number: QL55 I5
Descriptors: literature review, blood collection, injections, topical drug application, blood pressure measurement, urine collection, capture, minimize distress, validity of data, baboons, macaques, chimpanzees, drills, gorillas, marmosets, capuchins, vervets.

Reinhardt, V. and A. Reinhardt (1992). **Quantitatively tested environmental enrichment options for singly-caged nonhuman primates: a review.** *Humane Innovations and Alternatives* 6: 374-383.
NAL call number: QL55.H8
Descriptors: primates, laboratory mammals, cages, environmental enrichment, psychological wellbeing, animal welfare.

Reinhardt, V., C. Liss, and C. Stevens (1996). **Space requirement stipulations for caged non-human primates in the United States: a critical review.** *Animal Welfare* 5(4): 361-372.
NAL call number: HV4701.A557
Descriptors: primates, laboratory animals, cage size, height, space requirements, abnormal behavior, regulations, animal welfare.

Rollin, B.E. (1997). **An ethicist's commentary on the case of the infected research animal.** *Canadian Veterinary Journal* 38(3): 136.
NAL call number: 41.8 R3224
Descriptors: rats, veterinary medicine, animal welfare, infectious disease research.

Ruiven, R. van, G.W. Meijer, A. Wiersma, V. Baumans, L.F.M. van Zutphen, and J. Ritskes-Hoitinga (!998). **The influence of transportation stress on selected nutritional parameters to establish the necessary minimum period for adaptation in rat feeding studies.** *Laboratory Animals* 32(4): 446-456.
NAL call number: QL55 A1L3
Abstract: After transportation of rats by car and by air to and from the laboratory for a total period of 15 h, measurements were carried out for a period of 3 weeks after transport. Control and transported animals were housed in the same laboratory before and after transportation. During transport the animals had access to food and water. As blood collection could also cause stress, a factorial design was carried out with transport and blood collection as main factors (12 rats per group). Transport or blood collection did not cause significant effects on the following parameters: body weight, growth, clinical observation, and blood activities of lactate dehydrogenase and aspartate aminotransferase. Water intake was significantly increased after transport. Food intake did not show consistent effects after transport or blood collection. Unexpectedly, blood corticosterone levels were significantly lower in the transported animals at day 1 after transport. After 3 days these levels had returned to normal. Blood glucose, blood free fatty acids and blood urea nitrogen concentrations were incidentally decreased, whereas total cholesterol levels showed an incidental rise in the transported rats. The open-field behaviour test revealed no clear-cut results concerning the effects of transport or blood collection on faeces production, rearing and ambulation. It is concluded that after transport, an adaptation period of 3 days appears to be sufficient for rats to be used in nutritional studies.
Descriptors: adaptation, animal transport, rats, feeding studies, stress, blood collection, food intake, water intake, corticosterone, body weight, lactate dehydrogenase, aspartate aminotransferase, nutrition research.

Schlingmann, F., W.J. Pereboom, and R. Remie (1993). **The sensitivity of albino and pigmented rats to light. A mini review.** *Animal Technology* 44(2): 71-85.
NAL call number: QL55 I5
Abstract: Light is the most important environmental factor for animals. However, most animal facilities are designed for the convenience and comfort of the people who work in it, and not for the experimental animals. Several studies show that these light intensities are causing damage to the photoreceptor cells in the retina. Albino rats are especially more sensitive to light when compared to pigmented rats. Light values as recommended by several guidelines are often too high. Retinal degeneration seems not only to be dependent on intensity, but also on the wavelength of the light

source. Finally, the role of light in the maintenance of circadian rhythm is discussed.

Smith, K.R. and R.A. Markle (1998). **Capsaicin use in neonatal rats: Husbandry and welfare concerns.** *Lab Animal* 27(10): 38-40.
NAL call number: QL55 A1L33
Descriptors: Commonly used to induce long-lasting neural desensitization in neonatal rats, clinical side-effects, initial respiratory distress, skin lesions, urine retention, considerations when employing capsaicin treatment, animals may not show signs of pain and distress due to neural insensitivity, few papers in literature describe complications, complications may have acted as a selective force on experimental animals possibly altering data.

Toth, L.A., A.W. Dunlap, G.A. Olson, and J.R. Hessler (1989). **An evaluation of distress following intraperitoneal immunization with Freund's adjuvant in mice.** *Laboratory Animal Science* 39(2): 122-126.
NAL call number: 410.9 P94
Descriptors: adverse effects, immunization, pain, stress, adjuvants, Freund's, albumin, multiple granulomatous abdominal adhesions, lymphoid hyperplasia, animals did not appear to be chronically impaired, mice.

United Kingdom Coordinating Committee on Cancer Research guidelines for the welfare of animals in experimental neoplasia. (1989). Institute of Laboratory Animal Resources, National Research Council. *ILAR News* 31(3): 16-21.
NAL call number: QL55.A1I43
Descriptors: laboratory animals, animal welfare, neoplasms, guidelines, United Kingdom, tumor growth.

Voipio, H-M. (1997). **How do rats react to sound?** *Scandanavian Journal of Laboratory Animal Science* 24(Suppl. 1): 1-80.
NAL call number: QL55 S322
Descriptors: Ph. D. dissertation, review of literature, ultrasonic vocalizations, vocalizations, hearing ability, physiological responses, materials and methods, sounds used in experiments, chambers, experimental procedures, behavior monitoring, response to sounds, groups, female groups, pups, comparison of sexes, statistics.

Webster, A.J.F. (1998). **The nature of physiological stress.** In *Ethics, welfare, law and market forces: the veterinary interface. Proceedings of a Symposium, Royal College of Veterinary Surgeons, UK, 14-15th November 1996,* A.R. Michell and R. Ewbank, (eds.), Wheathampstead, UK: Universities Federation for Animal Welfare (UFAW), p.177-189.
NAL call number: HV4704 E84 1998
Descriptors: animal welfare, stress, adrenal cortex hormones.

Weihe, W.H. (1998). **The impact of stress and discomfort on experimental outcome.** *Archives of Toxicology* 20(suppl): 47-59.
NAL call number: RA1190 A7
Abstract: Stress refers to a physiological and emotional state of man and higher animals in which the autonomic regulation is overstrained and temporarily disturbed under the impact of conflicting stimuli. Stress activates, invigorates, acts life-sustaining, and initiates and drives adaptive changes towards improved fitness. While the positive action is commonly underestimated, much attention is given to the discomfort and the strain of efforts required during coping. The label of stress as being bad and the core of suffering has been applied with particular empathy to laboratory animals, for they are kept in captivity and are exposed to experimental procedures. The husbandry conditions to which the animals are adapted are commonly standardized. This applies to procedures for subacute and chronic toxicity testing. Acute toxicity tests are the classical example of stress research in which the demands on the organism exceed the limits of its regulative capacity. Stressors are: the test compound, the procedure proper and preceding treatment of the animal. The experimental stress contributes to model the real situation. The weighting between the stressors may modify the outcome of the test.
Descriptors: animal welfare, animal psychology, laboratory animal science, stress, physiopathology, toxicology, research.

Wiepkema, P.R., W.G.P. Schouten, and P. Koene (1993). **Biological aspects of animal welfare: new perspectives.**

Journal of Agricultural & Environmental Ethics 6 (special suppl.2): 93-103.
NAL call number: BJ52.5.J68
Descriptors: livestock, animal welfare, stress, emotions, social interaction.

Witkin, J.M. (1989). **Issues in the use of aversive stimuli in animal experimentation.** In *Science and Animals: Addressing Contemporary Issues* H.N. Guttman, J.A. Mench, and R. C. Simmonds (eds.), Bethesda, Maryland: Scientists Center for Animal Welfare, pp. 115-116.
NAL call number: HV4704.S33 1989
Descriptors: noxious stimuli, alternatives, parameters, evaluation of proposals.

Wolfensohn, S.E. (1997). **Brief review of scientific studies of the welfare implications of transporting primates.** *Laboratory Animals* 31(4): 303-5.
NAL call number: QL55 A1L3
Descriptors: primates, psychology, stress, animal husbandry, standards, physiology, transportation.

Zeller, W., G. Meier, K. Burki, and B. Panoussis (1998). **Adverse effects of tribromoethanol as used in the production of transgenic mice.** *Laboratory Animals* 32(4): 407-413.
NAL call number: QL55 A1L3
Descriptors: anesthesia, embryo transfer, ketamine, xylazine, histopathology, animal welfare.

Zutphen, L.F.M.van and M. Balls (eds.) (1997). ***Animal alternatives, welfare, and ethics, Proceedings of the 2nd World Congress on Alternatives and Animal Use in the Life Sciences, held in Utrecht, the Netherlands, 20-24 October 1996*** Amsterdam, New York :Elsevier, 1260 p.
NAL call number: QL1.D48 v.27
Descriptors: alternatives to animal testing, animal experimentation, animal welfare, laboratory animals, databases, literature searching.

Issues in Rodent Housing Bibliography

Arnold, C.E. and D.Q. Estep (1994). **Laboratory caging preferences in golden hamsters (Mesocricetus auratus).** *Laboratory Animals* 28(3): 232-238.
NAL call number: Ql55 A1L3
Descriptors: hamsters, housing, behavior, flooring, litter, animal welfare, cages, wire-bottoms, solid-bottom.

Boot, R., H. van Herck, and J. van der Logt (1996). **Mutual viral and bacterial infections after housing rats of various breeders within an experimental unit.** *Laboratory Animals* 30(1): 42-45.
NAL call number: QL55 A1L3
Abstract: Fifteen athymic rat strains from 11 breeding colonies were housed within an experimental facility for an immunological study. Health status records supplied with 14 of the strains listed infections by Kilham's rat virus (KRV), *Clostridium piliforme* (*Bacillus piliformis*) and *Pasteurella pneumotropica* for 2, 2 and 1 colonies respectively. In sera taken previous to the study from euthymic rats of 10 strains, antibodies to KRV were detected in 3 strains, to Pneumonia virus of mice (PVM), Rat corona virus (RCV) and Sendai virus in one strain each and to *P. pneumotropica* in 2 strains. Only 2 of the KRV infections had been reported by the supplier. During the study rats of all 10 strains developed antibodies to 2-4 of viral antigens. Eight out of 10 rat strains seroconverted to 1-5 of the antigens *C. piliforme* (*B. piliformis*), *Bordetella bronchiseptica*, *Haemophilus spp*., *P. pneumotropica* and *Streptobacillus moniliformis*. Two rat strains housed in filtertop cages did not develop antibodies to bacterial antigens. The potential detrimental effects of intercurrent infections on the outcome of the comparative immunological study are discussed.

Brown, K.J. and N.E. Grunberg (1995).**Effects of housing on male and female rats: crowding stresses male but calm females.** *Physiology and Behavior* 58(6): 1085-9.
NAL call number: QP1 P4
Abstract: Housing conditions affect behavioral and biological responses of animals. Effects of same-sex grouped, crowded, or individually housed conditions on plasma corticosterone levels of male and female Wistar rats were

examined in two experiments. Experiment 1 examined the effects of individual vs. crowded housing conditions on corticosterone, a biochemical index of stress, in seven male and seven female rats. Experiment 2 extended the findings of Experiment 1 by separately manipulating spatial and population aspects of housing with 50 male and 50 female rats. Male rats had higher corticosterone levels under crowded conditions. In contrast, female rats had higher levels when individually housed. Spatial crowding was the key variable for males, whereas the number of other animals was more important for females. These results indicate that investigators must consider housing conditions as an intervening variable that is likely to differentially affect behaviors of male and female rats.
Descriptors: behavior, housing, sex characteristics, sex differences, stress, physiopathology, analysis of variance; corticosterone, Wistar rats.

Clough, G. (1991). **Suggested guidelines for the housing and husbandry of rodents for aging studies.** *Neurobiology of Aging* 12(6): 653-8.
Abstract: The available published guidelines for the housing of rodents are reviewed, and assessments are made with regard to whether the data on which these guidelines are based appear to be sound. Ambient air temperature, relative humidity, lighting levels and photoperiods, sound levels, cage sizes, and ventilation rates are discussed, and a summary is provided covering the relationship between these and other factors and the well-being of laboratory rats and mice exposed to such conditions.
Descriptors: aging physiology, animal husbandry standards, housing standards, rodents.

Everitt, J.I., P.W. Ross, and T.W. Davis (1988). **Association of wire caging with development of mouse urological syndrome.** *Laboratory Animal Science* 38(4): 507.
NAL call number: 410.9 P94
Descriptors: mice, urinary tract diseases, cages, wire-bottoms.

Hurst, J.L., C.J. Barnard, C.M. Nevison, and C.D. West (1997). **Housing and welfare in laboratory rats: welfare implications of isolation and social contact among caged males.** *Animal Welfare* 6(4): 329-347.
NAL call number: HV4701 A557
Descriptors: animal welfare, physiopathology, housing, animal behavior.

Klir, P., R. Bondy, J. Lachout, and T. Hanis T (1984). **Physiological changes in laboratory rats caused by different housing.** *Physiologia Bohemoslovaca* 33(2): 111-21
Abstract: Males rats of the Wistar strain (Institute of Physiology, CSAV) were divided into six groups from the 30th to the 200th day of age. Rats (n=54) were put into cages in various numbers (1, 2, 3, 4, 6 and 8 animals in a cage) and were weighed regularly and the consumption of water and food was measured. At the end of the experiment the animals were killed and the weight of some organs and hematological values were determined. During the experiment the highest weight was attained in animals with 3 or 4 members in one cage. The differences in weight were significant from the 80th day of age. The consumption of diets and water was not influenced significantly by the number of animals in a cage. On the 200th day, the differences between the groups were found in the weight of some organs, and in some hematological values.
Descriptors: physiology, body weight, crowding, housing, rats, inbred strains, blood cell count, hematocrit, lung, organ weight, pituitary gland, testis, anatomy and histology.

Kuhnen, G. (1999). **Housing-induced changes in the febrile response of juvenile and adult golden hamsters.** *Journal of Experimental Animal Science* 39(4): 151-155.
NAL call number: QL1 J687
Descriptors: stress, body temperature, housing, animal welfare, fever, environmental enrichment, lipopolysaccharide, housing conditions significantly affect febrile response of juvenile and adults, hamsters.

Manser, C.E., H. Elliott, T.H. Morris, and D.M. Broom (1996). **The use of a novel operant test to determine the strength of preference for flooring in laboratory rats.** *Laboratory Animals* 30(1): 1-6.
NAL call number: QL55 A1L3
Abstract: A previous study showed that laboratory rats preferred to dwell on a solid floor rather than a grid one, particularly when resting (Manser et al. 1995). The strength of this preference was investigated in an operant trial using a novel test apparatus, which consisted of a grid-floored cage and a solid-floored cage, joined via a central box

containing a barrier whose weight was adjustable. Trials in which rats had to lift the barrier in order to explore the whole apparatus were alternated with those in which the rats were confined on the grid floor and then had to lift the barrier in order to reach the solid floor. The latter trials were carried out at the beginning of the light period when the rats were seeking a resting place. In both trials, theweight of the barrier was progressively increased for each rat, until a maximum weight was found which it would lift either to explore its environment (weight A) or to reach the solid floor (weight B). No significant differences were found between weights A and B, showing that rats would work as hard to reach a solid floor to rest on as they would to explore a novel environment. The apparatus used could, with some modifications, be appropriate for use in other operant studies in laboratory rats.

Manser, C.E., T.H. Morris, and D.M. Broom (1996). **An investigation into the effects of solid or grid cage flooring on the welfare of laboratory rats.** *Laboratory Animals* 29(4): 353-363.
NAL call number: QL55 A1L3
Abstract: The welfare of laboratory rats housed on either solid or grid floors was investigated in several ways. No differences were found in body weight gain, food consumption or water consumption amongst rats housed in either condition. When handling was standardized between the 2 groups, there was no correlation between flooring and docility. Preference testing revealed that rats chose to dwell on solid floors rather than grids, regardless of previous housing experience. This preference for solid floors was particularly marked (88%) when the animals were resting and much less marked during activity (55.4%). Since the rats were observed to spend 70 to 75% of their time resting, it was concluded that their welfare was likely to be improved by housing them on solid floors.

Milligan, S.R., G.D. Sales, K. Khirnykh (1993). **Sound levels in rooms housing laboratory animals: an uncontrolled daily variable.** *Physiology & Behavior* 53(6): 1067-76.
NAL call number: QP1 P4
Abstract: High sound levels are known to have adverse effects on the behaviour and physiology of laboratory animals, yet their acoustic environment is rarely monitored. In particular, high-frequency sounds that are above the limit of human hearing, but are well within the limits of many laboratory species (i.e., ultrasounds), are usually ignored. In this study, the acoustic environment of laboratory animals was investigated in a variety of different animal facilities. Sound pressure levels (dB SPL) were monitored for periods up to 24 h over two frequency ranges: a relatively low range (0.01-12.5 kHz), and a high range (12.5-70 kHz). While background sound levels in undisturbed situations were generally low (i.e., below 50 dB SPL), marked increases in sound levels often occurred during the working day, producing characteristic daily variations in the sound profile. Peak SPLs commonly reached values of 80-95 dB in the low-frequency range and 50-75 dB in the higher range. In most cases, sound levels were low over weekends. The results suggested that human activities were a very important source of sound in most animal facilities. In a few situations (e.g., rabbits, marmosets, dogs), the animals themselves provided a significant contribution to the acoustic environment. It is clear that the acoustic environment of laboratory animals is a daily variable that is usually uncontrolled and that may have important implications for behavioural and physiological experiments and for animal welfare.
Descriptors: animal welfare, arousal, noise, social environment, Callithrix, cats, circadian rhythm, ferrets, loudness perception, mice, pitch perception, psychoacoustics, rabbits, rats, sound spectrography, species specificity, ultrasonics.

Mizisin, A.P., M.W. Kalichman, R.S. Garrett, and K.C. Dines (1998). **Tactile hyperesthesia, altered epidermal innervation and plantar nerve injury in the hindfeet of rats housed on wire grates.** *Brain Research* 788(1-2): 13-19.
Abstract: The effects of wire grates on nerve injury and recovery were examined in rats housed in cages with sawdust-covered solid flooring. For the first 3 weeks of the study, 20 rats were housed on sawdust alone and 20 rats were housed in cages with wire grates placed over the sawdust. For the remaining 9 weeks, 10 animals housed on sawdust had wire grates added to their cages, while grates were removed from the cages of 10 animals. The effects of tactile stimulation on hindpaw plantar skin was measured weekly using the Von Frey filament test. Intraepidermal innervation using PGP 9.5 immunostaining and plantar nerve histology were assessed at the end of the 12-week study. After just 1 week on grates, hindpaw withdrawal thresholds were already markedly decreased and remained low until the grates were removed at 3 weeks. Thresholds returned to normal by 4 weeks after removal of the grates. Wire grates also induced increases in PGP 9.5 immunoreactive intraepidermal fine nerve endings that were normalized after grate removal. Demyelination, Wallerian degeneration and Renaut bodies were induced in the medial plantar nerve in rats housed in cages with wire-grate flooring. Nerve injury was largely resolved after 9 weeks on sawdust flooring. These data

demonstrate that wire grates rapidly induce hindpaw tactile hyperesthesia and plantar neuropathy in rats and emphasize a risk of using wire-grate cage flooring in studies assessing hindlimb function and structure.
Descriptors: epidermis innervation, foot innervation, hyperesthesia, peripheral nerves injuries, hindlimb, housing, immunohistochemistry, Sprague-Dawley rats, wire-bottoms.

Olfert, E. D. (1998). **A rodent's-eye view of environmental enrichment: Asking the animal what it prefers.** *CALAS/ACSAL Newsletter* 32(5): 9-13.
NAL call number: SF405.5 C36
Descriptors: behavioral needs, natural behavior, preference testing, interpreting results, strength of a preference, preference and animal welfare, floor types, bedding, nesting material, shelters, enrichment devices, nest boxes, mice, rats, the "preferred mouse cage," the "preferred rat cage."

Perez, C., J.R.Canal, E. Dominguez, J.E. Campillo, M. Guillen, M.D. Torres (1997). **Individual housing influences certain biochemical parameters in the rat.** *Laboratory Animals* 31(4): 357-61.
NAL call number: QL55 A1L3
Abstract: Individual housing has been reported to modify animal behaviour. The present study compares the plasma levels of glucose, triglycerides and total cholesterol, weight, and food and water intake in two groups of female rats. Group A: 10 rats who remained grouped in two cages for 21 days; and Group B: 10 rats housed in two cages for 7 days, then isolated in individual cages from day 8 to day 15, and finally grouped together again for the last 7 days of the study. The results showed that the plasma values of glucose declined ($P < 0.05$) in the Group B rats when they had been returned to group condition (4.79 +/- 0.72 mM) than when they had been isolated (5.45 +/- 0.94 mM). Plasma triglyceride levels were lower ($P < 0.05$) in isolated rats (0.70 +/- 0.26 mM) than in any determination of the grouped rats. Group B: 1st week 1.21 +/- 0.21 mM, 3rd week 0.88 +/- 0.20 mM; and Group A: 1.22 +/- 0.20, 0.96 +/- 0.16, and 0.96 +/- 0.36 mM, in the first, second, and third week, respectively. There were no statistically significant differences in total cholesterol values as a function of the individual housing of animals. While there was no weight difference between the two groups of rats that could be ascribed to individual housing, there was a statistically significant increase ($P < 0.05$) in the food intake of isolated rats (17.5 +/- 3.2 g) with respect to values in the same Group B animals when they were housed together (1st week, 16.6 +/- 2.8 g; 3rd week, 16.8 +/- 3.1 g). These results therefore confirm that individual housing of female rats provoke variations in certain biochemical parameters, and that if this is not taken into account in performing different scientific studies, it could give rise to unreliable or even dubious results.
Descriptors: animal behavior, animal physiology, pH, blood glucose analysis, cholesterol, housing, triglycerides, drinking, eating, Wistar rats, social isolation.

Perkins, S.E. (1996). **Evaluation of microenvironmental conditions and noise generation in three individually ventilated rodent caging systems and static isolator cages.** *Contemporary Topics in Laboratory Animal Science* 35(2): 61-65.
NAL call number: SF405.5 A23
Descriptors: caging, contaminants, environmental temperature, relative humidity, carbon dioxide, ammonia, noise level, significant differences reported between cage types for all parameters measured, mice.

Raynor, T.H., W.H. Steinhagen, and T.E. Hamm (1983). **Differences in the microenvironment of a polycarbonate caging system: bedding vs raised wire floors.** *Laboratory Animals* 17(2): 85-9.
NAL call number: QL55 A1L3
Abstract: The microenvironment of polycarbonate cages housing rats with and without various types of bedding was compared with that of cages that utilized wire floor inserts with different bedding types. Parameters monitored were temperature, humidity, ammonia concentrations and particulates. No differences were noted in the various caging types in relation to temperature and humidity measurements. Significant differences in ammonia concentrations existed in some of the cages when bedding material was used. The use of raised floorwalk inserts also demonstrated significant differences in particulate counts to cages without inserts. The data obtained demonstrated that contact bedding was useful in controlling ammonia generation and that a raised floorwalk insert reduced significantly the aerosolization of bedding particles that could be ingested or inhaled by the rats.
Descriptors: animals, housing ammonia, animal husbandry, bedding, humidity, polymers, rats, temperature.

Rock, F.M., M.S. Landi, H.C. Hughes, R.C. Gagnon (1997). **Effects of caging type and group size on selected**

physiologic variables in rats. *Contemporary Topics in Laboratory Animal Science* 36(2): 69-72.
NAL call number: SF405.5 A23
Descriptors: caging, group-size, body temperature, heart rate, blood pressure, feed intake, body weight, animal husbandry, rats, motor activity, cage types had significant effects on motor activity and feed intake.

Salvin, S.B., B.S. Rabin, and R. Neta (1990). **Evaluation of immunologic assays to determine the effects of differential housing on immune reactivity.** *Brain, Behavior, and Immunity* 4(3): 180-8.
Abstract: The mechanism is being investigated to determine specifically how an environmental variation such as differential housing can influence the multiple components of the host defense mechanism. Male C3H/HeJ mice were housed either one or five per cage. Cells and sera from these mice were analyzed and compared by several immunologic techniques to determine in which cells or tissues the effect of differential housing was most pronounced. The individually housed mice (a) had a greater capacity to phagocytose dead cells of *Candida albicans*. (b) had spleens that produced more macrophage colony stimulating factor (M-CSF). (c) were more responsive to M-CSF, (d) had peritoneal macrophages that released greater quantities of interleukin-1 in vitro into the surrounding medium and that had a greater capacity to migrate toward a chemotactic stimulus, and (e) had higher titers of IgM hemagglutination antibody to sheep erythrocytes. Differential housing of mice may therefore be a highly important modulator and indicator of the nature and extent of an animal's immunologic response to an environmental stimulus.
Descriptors: antibody formation, housing, cellular immunity, leukocyte chemotaxis, hemagglutination tests, hematopoietic stem cells, drug effects, IgM biosynthesis, interleukin-1 secretion, macrophage colony-stimulating factor--pharmacology, macrophages, mice, inbred C3H mice, peritoneal cavity, phagocytosis, spleen cytology, chemical stimulation.

Weerd, H. A. van de, P.L.P. van Loo, L.F.M. van Zutphen, J.M. Koolhaas, and V. Baumans (1998). **Strength of preference for nesting material as environmental enrichment for laboratory mice.** *Applied Animal Behaviour Science* 55(3/4): 369-382.
NAL call number: QL750 A6
Descriptors: environmental enrichment, nesting mice, cages, litter, floor husbandry; floor type, animal behavior, animal welfare, wire-bottoms.

Weerd, H.A. van de, F.A.R. van den Broek, and V. Baumans (1996). **Preference for different types of flooring in two rat strains.** *Applied Animal Behaviour Science* 46(3/4): 251-261.
NAL call number: QL750 A6
Abstract: Bedding material is a permanent part of the environment of laboratory rodents. In the present study, rats of two strains (Wistar HsdCpb:WU and Brown Norway BN/SsNCpbHsd) were placed in a preference test system to evaluate their preference for three types of bedding material (sawdust, softwood shavings and paper particles) compared to wire mesh. The rats showed a significant preference for the cages with wood shavings and paper bedding, both consisting of large particles. The paper bedding may serve as an alternative to wire mesh floor in some (e.g. toxicological) studies, because of its defined composition. The cages with sawdust and wire mesh floor were relatively avoided. Rats slept in the cages with large-particle bedding, but used the other cages for active behaviour such as eating and defecating; furthermore, many rats preferred different cages during day and night. It is suggested that different behavioural activities may require different cage floor covering.

Yoganathan, S., T.A. Wilson, and R.J. Nicolosi (1998). **Housing conditions effect plasma lipid concentrations and early atherogenesis independent of treatment in hamsters.** *Nutrition Research* 18(1): 83-92.
NAL call number: 389.8 N954
Descriptors: lipoproteins, atherogenesis, atherosclerosis, housing, blood, hypercholesterolaemia, cholesterol, intake, triacylglycerols, hamsters, housing conditions affect plasma lipids.

Zochodne, D.W., M.N. Murray, P. van der Sloot, and R.J. Riopelle (1995). **Distal tibial mononeuropathy in diabetic and nondiabetic rats reared on wire cages: an experimental entrapment neuropathy.** *Brain Research* 698(1-2):130-136.
Abstract: Using electrophysiological recordings, we studied a distal tibial mononeuropathy that involves the hind foot of rats reared in cages with wire grid flooring. In an initial set of experiments, serial sciatic-tibial motor conduction recordings were made in smaller or larger rats reared in cages with wire grid or sawdust flooring. Electrophysiological

features of the neuropathy were loss in the amplitude of the distal tibial nerve M potential recorded over hind limb foot muscles, temporal dispersion of the potential, often into multiple peaks, and a prolonged distal latency of the response. The changes in M amplitude were more apparent in larger rats with a greater body weight. In a second series of experiments we studied sciatic-tibial conduction over 16 weeks in nondiabetic rats and rats rendered diabetic with streptozotocin raised and wire grid or plastic flooring. Tibial mononeuropathy developed in both wire grid-reared groups, but there was evidence that it appeared earlier in diabetic rats. Electrophysiological changes of distal mononeuropathy also obscured the expected slowing of sciatic-tibial motor conduction velocity from diabetics. Tibial mononeuropathy in rats reared on wire grid flooring may be a useful animal model of human entrapment neuropathy but its presence can confound studies of experimental neuropathy. Rats used in studies of experimental neuropathy should be housed in plastic cages with sawdust or shavings flooring.
Descriptors: experimental diabetes mellitus, diabetic neuropathies, housing, nerve compression syndromes, sciatic nerve, tibial nerve, analysis of variance, diabetes mellitus complications, Sprague-Dawley rats, wire-bottoms.

Useful World Wide Web Sites

Blood collection in mice using the saphenous vein - An alternative to retro orbital collection
http://www.uib.no/dyreavd/Vivarium-blood-sampling.pdf (PDF 847KB)
The method has been developed by the Laboratory Animal Centre of the Norwegian Institute of Public Health by Annelise Hem and Per Solberg. Annelise Hem and Adrian Smith have submitted a paper on saphenous vein puncture to the journal "Laboratory Animals". They have successfully used this technique on mice, rats, hamsters, gerbils, guinea-pigs, mink and ferrets.

Environmental Enhancement for Caged Rhesus Macaques-A Photographic Documentation
http://www.primate.wisc.edu/pin/pef/slide/intro.html
Defining improved 'psychological well-being' as having the option to actively express species-typical behavior patterns that were formerly inhibited due to a lack of appropriate stimuli, and experiencing less fear/distress in the presence of people, the author developed and implemented the following environmental enhancement plan for the center's colony of approximately 700 caged rhesus macaques (Macaca mulatta).

Guidelines for the Production of Polyclonal and Monoclonal Antibodies in Rodents and Rabbits
http://www.upstate.edu/iacuc/pdf/antibody_neoplasia_2_antibody_guidelines.pdf
This site is maintained by the State University of New York Health Science Center at Syracuse. The purpose of these Guidelines is to provide methods with demonstrated success that also minimize pain and distress for the laboratory animals employed in the technique.

National Institutes of Health, Animal Research Advisory Committee (ARAC)
http://oacu.od.nih.gov/ARAC/documents/Toe_Clipping.pdf
Recommendation on toe clipping of animals.

University of Arizona Department of Animal Care
http://www.ahsc.arizona.edu/uac/notes/classes/schedule.html
This site provides extensive information on handling, restraint, and techniques of laboratory rodents.

University of Minnesota, Research Animal Resources
http://www.ahc.umn.edu/rar/housing.html
Husbandry guidelines for laboratory animals including rodent cage floor policy.

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Updated June 18, 2014

Food Deprivation or Water Deprivation

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Guidelines for Diet Control in Behavioral Studies

Adopted by National Institutes of Health-Animal Care and Use Committee on 6/13/90.
Reapproved - 5/8/96.
Reapproved - 2/10/99.
This document is available at http://oacu.od.nih.gov/ARAC/documents/ASP_Endpoints.pdf

Behavioral research often requires that an animal perform a task for which it receives food or fluid reward. This situation is not unlike conditions in the wild, in which animals must forage, travel distances, solve problems, or otherwise work to obtain their food and water. In the professional judgement of many investigators, performing a task for rewards is behaviorally enriching for laboratory animals, especially nonhuman primates.

The purpose of this document is to provide investigators with guidelines for the proper use of diet control in behavioral studies.

Food

Whenever an animal obtains any portion of its diet through food reward, the investigator must ensure that the sum of the nutritional value of the food earned through reward and of the food provided "free" (without the necessity of earning it) is sufficient to maintain the animal in a healthy state. Whenever possible, the food reward should be a "treat" (e.g., raisins, peanuts) which is sufficiently desirable and motivating for the animal that dietary restriction is unnecessary. However, dietary restriction may be justified in some cases, depending on the species, the behavioral task, and the requirements of the research proposal. In such cases, food must be provided every day, unless a specific exception to this policy has been obtained in an approved research proposal. In addition, weekly weight records must be kept, which should be available for examination by the veterinary staff and the ACUC.

If an animal under diet restriction loses more than 15% of its body weight (compared to its weight measured prior to the restriction) its food intake should be increased immediately until it regains its normal weight (+/- 15%). Exceptions to this policy will be allowed only if the attending or facility veterinarian determines that the weight loss does not endanger the health of the animal (as, for example, in the case of an animal that was initially overweight), or if prior approval has been obtained from the ACUC for the specific animal study proposal. Young, developing animals may have additional dietary requirements for maintaining their normal rate of growth; investigators working with young animals should specifically address this issue in their animal study proposal. The ACUC is aware that certain strains of large rats (e.g., Sprague-Dawley) may require up to a 20% loss of body weight before performing a behavioral task for

rewards. Exceptions to the 15% maximum weight loss policy (up to a maximum of 20% weight loss) will be considered in such cases, but only if such strains are adequately justified in the animal study proposal.

Fluid

As with food intake, whenever an animal obtains any portion of its fluid requirements through fluid rewards in behavioral testing, the investigator must ensure that the sum of the fluid earned through reward and the fluid provided "free" (without the necessity of earning it) is sufficient to maintain the animal in a healthy state. When water is not provided ad libitum, either the animal should be permitted to earn fluids to satiety during the period of behavioral training or its fluid intake should be appropriately supplemented on a daily basis.

In cases where supplements are required, the minimum amount of fluids to be provided daily should be equivalent to the amount typically consumed by the animal when either it is permitted to earn fluids to satiety or it is provided with water ad libitum. An exception to this policy will be made for the day immediately following a 24 hour or longer period in which the animal is provided with fluids ad libitum. On such days only, a reduced fluid supplement is permitted, but only if the normal supplement is demonstrated to interfere with behavioral training.

Assessment of adequacy of fluid intake

Even though animals typically learn to meet all of their daily fluid requirement during the testing session, a number of precautions must be taken to avoid the possibility of acute dehydration or chronic fluid deficiency. The type (e.g. water, fruit juice) and concentration, if applicable, of the fluid reward should be specified in the animal study proposal. Daily records of fluid intake must be maintained and be available for review by the veterinary staff and the ACUC. Each animal under fluid restriction will be observed daily for health status by the animal care staff. If the Institute veterinarian determines that an animal is dehydrated on the basis of either physical examination or clinical pathological measurements, the animal's fluid intake must be immediately increased. A small but chronic fluid deficiency, however, may occasionally escape detection by physical observation.

Such chronic fluid deficiencies often result in a loss of body weight due to reduced food consumption. Therefore, as a further precaution against chronic deficiency, the animal's weight must be measured and recorded at no less than weekly intervals. If an animal shows a loss in body weight of more than 15%, fluids must be increased appropriately. Exceptions to this policy will be allowed only if the attending or facility veterinarian determines that an animal is adequately hydrated and that the weight loss does not endanger its health or prior approval has been obtained from the ACUC for the specific animal study proposal.

Bibliography

Albee, R.R., J.L. Mattsson, B.L. Yano, and L.W. Chang (1987). **Neurobehavioral effects of dietary restriction in rats.** *Neurotoxicology and Teratology* 9: 203-211.
Descriptors: male Fischer rats, body weights, grip strength, body temperature, flash evoked potential, auditory brainstem response, somatosensory and cerebellar evoked responses, caudal nerve action potentials, cortical flicker fusion, Feed restriction protocol involved feeding 15 percent (mild) or 50 percent (severe) less feed than controls had consumed (ad lib) the previous day. Dietary restriction has significant effects on numerous behavioral and neurophysiological parameters that should be considered in the interpretation of data when body weight differences are present, diet restricted rats were more excitable while restrained for testing.

Driscoll, P., J.R. Martin, P. Kugler, and K. Baettig (1983). **Environmental and genetic effects on food-deprivation induced stomach lesions in male rats.** *Physiology and Behavior* 31(2): 225-228.
NAL call number: QP1.P4
Abstract: When Roman high- and low-avoidance (RHA/Verh and RLA/Verh) rats were individually housed in plastic

cages with sawdust bedding and food-deprived (F-D) for 4-5 days, it was found that F-D RHA/Verh rats had more lesions than their unfasted controls and more lesions than F-D RLA/Verh rats. The lesions were mostly petechial in nature and located in the glandular portion of the stomach. Also, F-D RHA/Verh rats which were housed in the same room as the controls, as well as F-D RHA/Verh rats which were housed in a separate room with a strong food odor present, had more lesions than F-D RHA/Verh rats housed in the same separate room when there was no food odor, and when none of the rats present had access to food. When F-D RHA/Verh and F-D RLA/Verh rats were individually housed in metal cages with grid floors, however, a general increase in lesion scores resulted and differences between the two rat lines disappeared, as did differences among the room conditions. Also, many lesions were of an ulcerative nature and were located in the rumenal portion of the stomach. It was concluded that sensory (in this case olfactory, at least) and genetic factors are capable of playing roles in the induction of stomach lesions in rats, and that the type, extent and location of the lesions can depend upon whether or not the animals have access to sawdust bedding.
Descriptors: food deprivation, housing, odors, inbred rat strains, stomach ulcers, body temperature regulation, gastric acid secretion, purpura etiology, stomach diseases, wood, litter.

Hughes, J.E., H. Amyx, J.L. Howard, K.P. Nanry, and G.T. Pollard (1994). **Health effects of water restriction to motivate lever-pressing in rats.** *Laboratory Animal Science* 44(2): 135-140.
NAL call number: 410.9 P94
Abstract: The objectives of this study were to determine the degree of water restriction necessary and sufficient to motivate acquisition and performance of a lever-press response in rats and the physiologic and general health effects of chronic daily restriction. Parameters examined included: hematological and clinical chemistry, body weight, gross necropsy, clinical examination.

Hohenegger, M., U. Laminger, P. Om, A. Sadjak, K. Guttmann, and M. Vermes (1986). **Metabolic effects of water deprivation.** *Journal of Clinical Chemistry and Clinical Biochemistry* 24(5): 277-282.
NAL call number: RB40.A1Z4
Descriptors: dehydration, resuscitation, experimental disease.

Horne, T., A. Gutman, S.H. Blondheim, and H.B. Aronson (1982). **Effects of 24 hour food and water deprivation on biochemical variables in blood.** *Israel Journal of Medical Sciences* 18(5): 591-595.
Descriptors: humans, 2.5 fold increase in plasma free fatty acids, 2 fold increase in bilirubin, significant increases in serum sodium, chloride, total proteins, albumin, uric acid, phosphorous, alkaline phosphatase, and aspartate aminotransferase, decrease in serum glucose and triglycerides, no changes in urea, potassium, cholesterol, or calcium.

Kyriazakis, I. and C.J. Savory (1997). **Hunger and thirst.** In *Animal Welfare,* M.C. Appleby and B.O. Hughes, (eds.), Oxon, UK and New York: CAB International, pp. 49-62.
NAL call number: HV4711.A586 1997
Descriptors: nutrient requirements, animal behavior, animal welfare, hunger, thirst, definitions, measurements of hunger, sources of malnutrition, sources of undernutrition, restriction, deprivation, welfare problems, behavioral problems related to restriction, stress related physiological problems, farm animals, laboratory animals.

Laties, V. (1987). **Control of animal pain and distress in behavioral studies that use food deprivation or aversive stimuli.** *JAVMA (Journal of the American Veterinary Medical Association)* 191(10): 1290-1291.
NAL call number: 41.8 Am3
Descriptors: overview of food deprivation in behavioral studies, effects of feed restriction, effects of handling and injections, overview of studies where pain is being studies.

Levin, S., D. Semler, and Z. Ruben (1993). **Effects of two weeks of feed restriction on some common toxicologic parameters in Sprague-Dawley rats.** *Toxicologic Pathology* 21(1): 1-13.
Abstract: This study was intended to identify changes caused by short-term reduced feed intake in rats such as may occur with unpalatable feed or other forms of anorexia. For 2 wk, groups of rats (10/sex/group) were fed ad libitum (control group) or given 75% (mildly restricted group), 50% (moderately restricted group), or 25% (severely restricted group) of the amount of feed eaten the day before by controls. The control group and mildly restricted group grew steadily, but the terminal body weights of the mildly restricted group (both males and females) were only about 80% of controls. The moderately restricted group did not grow during the first week but grew slightly during the second week

(terminal body weights about 65% of control). The severely restricted group lost weight throughout the study (terminal weight about 40% of control). Restricted groups exhibited hemoconcentration directly related to the degree of feed restriction. White blood cell counts were reduced (principally due to lymphopenia) in severely restricted rats. Platelet counts were decreased in all restricted groups. Total serum protein concentration was reduced (decreased globulins) in all female restricted groups and in the severely restricted males. The severely restricted rats had increased serum bilirubin, electrolyte derangements, and (in females only) decreased cholesterol. Thymus and liver weights (absolute and relative) were decreased in the moderately and severely restricted groups. All the feed-restricted groups had an increased incidence of superficial gastric erosions. The mildly and moderately restricted groups had slightly decreased hematopoietic tissue in sternal bone marrow, while the severely restricted group had bone marrow necrosis, thymic atrophy, and mild testicular degeneration. Findings in the severely restricted group were distinct from those in the other groups on the basis of their severity and were considered adverse. Changes in the mildly and moderately restricted groups were considered adaptive and innocuous since feed restriction of this degree has historically been associated with increased longevity and decreased disease incidence in chronic studies.

Levine, S. and A. Saltzman (1998). **An alternative to overnight withholding of food from rats.** *Contemporary Topics in Laboratory Animal Science* 37(3): 59-61.
NAL call number: SF405.5 A23
Abstract: Withholding of food overnight has been used for numerous experimental purposes, including to reduce errors of intraperitoneal injections by diminishing the size and weight of the gastrointestinal tract, to prepare for gavage or surgery, or to avoid the effects food in the gastrointestinal tract might exert on drugs or nutrients. However, withholding food overnight causes undesirable side effects including loss of body and hepatic weight and decreases in blood glucose concentrations. Withholding food from rats housed on bedding can also lead to ingestion of bedding. Providing rats with commercially available sucrose cubes overnight ameliorated these undesirable effects while still reducing the size of the gastrointestinal tract. Rats housed in cages without access to bedding had an additional reduction in weight of the gastrointestinal tract. Analysis of the results indicated that providing sucrose cubes overnight and reducing access to bedding was an effective alternative to overnight withholding of all food.
Descriptors: methods, food deprivation, fasting, digestive tract, drugs, body weight, hepatic weight, blood sugar, bedding, sucrose, liver, rats.

Preparation and Maintenance of Higher Mammals During Neuroscience Experiments. Report of a National Institutes of Health Workshop, March 1991 . Bethesda, Maryland: DHHS, Public Health Service, National Institutes of Health, 45 p.
NAL call number: HV4930.P74
Descriptors: prolonged non-survival recording procedures, survival anatomical procedures, perinatal procedures, food and water restriction, inducing neurological deficits, awake behaving preparations, animal care and use concerns, sample research protocols.

Ray, S. (1998). **An alternative to water deprivation techniques in animal learning studies.** *Animal Technology* 49(3): 113-120.
NAL call number: QL55.I5
Abstract: Many laboratories use a period of water deprivation to motivate animals on a variety of water reinforced learning paradigms including aversive conditioning and maze learning tasks. Such procedures can lead to long periods without water and increase inter-animal variability in learning performance. Reported is an alternative procedure using sucrose rich drinks, or sucrose solutions, as a reward in maze and discrimination learning procedures with no prior water deprivation. An initial experiment compares performance over trials of a water deprived group of rats learning to negotiate a Y maze, and a group of genetically matched animals running an identical maze with no water deprivation. Both groups negotiating the maze for a sucrose reward. Results show that non-deprived animals showed teaming that was equally as good as the water deprived animals. Similar results were confirmed in a Lashley jump stand discrimination task. The ability to study learning in non-deprived animals may be of great interest in studies of learned behaviour after lesion or other surgical interventions, when periods of dehydration may affect the animal's health. Further, the development of non-deprivation motivated techniques will reduce the severity of many commonly employed rodent learning paradigms. These results may also offer a useful heuristic to explore learning paradigms without food or water deprivation schedules in other species.

Schwartz, E., J.A. Tornaben, and G.C. Boxhill (1973). **The effects of food restriction on hematology, clinical chemistry, and pathology in the albino rat.** *Toxicology and Applied Pharmacology* 25(4): 515-524.
NAL call number: 391.8 T662
Descriptors: body weight, blood enzyme levels, erythrocyte counts, hematocrit, alanine aminotransferase, alkaline phosphatase, blood glucose, platelets, blood urea nitrogen, leukocyte count, organ weight, sex factors, time factors.

Shimamura, T. and S. Trojanowski (1976). **Effects of repeated deprivation of drinking water on the structure of the renal medulla of rats.** *American Journal of Pathology* 84(1): 87-92.
NAL call number: 442.8 AM39
Descriptors: pathological changes in renal medulla, tubulointerstitial nephritis, dehydration.

Vermeulen, J.K., A. de Vries, F. Schlingmann, and R. Remie (1997). **Food deprivation: Common sense or nonsense?** *Animal Technology* 48(2): 45-54.
NAL call number: QL55.I5
Abstract: Overnight fasting (food deprivation) is a very common procedure in pharmacological research. One of the many reasons is to empty the animal's stomach. Solvay Duphar investigated the effects of overnight fasting and the possibility to shorten the period of the overnight fasting on male Wistar rats. In case of the effects being far-reaching (quality research and animal well-being), it might be necessary to develop an alternative method. This experiment fits very well in the concept of the 3 R's of Russell and Burch. The experiment used 24 male rats. There were four experimental units. The rats were deprived respectively for 0 hours (controls), 6, 12, or 18 hours. This was done during the dark phase of the (facility) light cycle. A balance plateau was used for registration of animal behavior. After the deprivation, the animals were anesthetized with halothane (N_2O/O_2) and killed by decapitation. Liver weight, stomach contents, and bowel contents were parameters to be measured. Food deprivation causes severe changes in physiology and behavior of the rat. After six hours of food deprivation, the rat already has an empty stomach. The use of fasted rats in experiments seems only to be permitted when the duration of food deprivation is as short as possible.
Descriptors: experimental methods, animal behavior, drinking, eating, locomotion, grooming, resting, physiological changes.

Useful World Wide Web Sites

University of California at Irvine
http://www.research.uci.edu/ora/acup/foodrestriction.htm
Policy for Food or Fluid Restriction

University of Colorado Health Sciences Center, Animal Care & Use Program
http://www.colorado.edu/VCResearch/integrity/animalcare/index.html
Water and/or Food Restriction; To get to this policy, click on Care and Use Policies in the left frame on the web page.

University of Vermont, Institutional Animal Care and Use Committee
http://www.uvm.edu/~oacm/
Food or Fluid Restriction, Definitions, Policies and Guidelines

Last updated June 18, 2014

Pain Management and Humane Endpoints

- Defining an Acceptable Endpoint in Invasive Experiments
  (links to the article previously published in the Animal Welfare Information Center Newsletter)
- Endpoints in Animal Study Proposals - NIH
- Assessment and Alleviation of Post-Operative Pain
  (links to the article previously published in the Animal Welfare Information Center Newsletter)
- Guidelines for Euthanasia of Mouse and Rat Fetuses and Neonates
- Bibliography
- Useful World Wide Web Sites

Endpoints in Animal Study Proposals

Guideline revised and approved by the National Institutes of Health Animal Research Advisory Committee on March 8, 2000. It is available at http://oacu.od.nih.gov/ARAC/documents/ASP_Endpoints.pdf

Introduction

Experimental studies may involve procedures that cause clinical symptoms or morbidity in animals. The Animal Care and Use Committee must consider the selection of the most appropriate endpoint(s). This requires careful consideration of the scientific requirements of the study, the expected and possible adverse effects the research animals may experience (pain, distress, illness, etc.), the most likely time course and progression of those adverse effects, and the earliest most predictive indicators of present or impending adverse effects. The effective use of endpoints requires that properly qualified individuals perform both general and study specific observations of the research animals at appropriate time points. Optimally, studies are terminated when animals begin to exhibit clinical signs of disease if this endpoint is compatible with meeting the research objectives. Such endpoints are preferable to death or moribundity as endpoints since they minimize pain and distress. Efforts must be made to minimize pain and distress experienced by animals used in research.

Morbidity

Animal Study Proposals that include morbidity as an endpoint or that include animal procedures that have the potential to cause adverse sequella should address the following:

1.Criteria that establish when the endpoint has been reached.

A. There are several examples in the literature that might be considered, including:

1.Evaluation of five aspects of an animal's condition as described by Morton and Griffiths. These are body weight, physical appearance, measurable clinical signs, unprovoked behavior and response to external stimuli.

2.Clinical observations used in cancer research and toxicological studies as described by Montgomery. Parameters include changes in general appearance, skin and hair, eyes, nose, mouth and head, respiration, urine, feces and locomotion (see table 2 on page 339).

B. The clinical signs, depending on severity and duration, that may constitute an endpoint include, but are not limited to:

- Rapid weight loss.
- Diarrhea, if debilitating.
- Progressive dermatitis.
- Rough hair coat, hunched posture, lethargy or persistent recumbency.
- Coughing, labored breathing, nasal discharge.
- Jaundice and/or anemia.
- Neurological signs.
- Bleeding from any orifice.
- Self-induced trauma.
- Any condition interfering with eating or drinking (e.g. difficulty with ambulation).

- Excessive or prolonged hyperthermia or hypothermia.

C. Additional signs in neoplasia studies that may constitute an endpoint include, but are not limited to:

1. A tumor burden greater than 10% bw, and in an adult mouse, a mean tumor diameter exceeding 20 mm or in an adult rat, a mean tumor diameter exceeding 40 mm. Formulas for calculating tumor size can be found in the literature (see tumor size ref.).

2.Tumors that ulcerate, become necrotic or infected.

D.Any animal found unexpectedly to be moribund, cachectic, or unable to obtain food or water.

2.A plan for monitoring the animals both before and after a change in any of the above aspects, providing care if appropriate, and increasing the level of monitoring. Monitoring or clinical care on weekends and holidays may require involvement of the investigative staff to supplement that provided by the animal care and veterinary staff.

3.Identification of personnel responsible for evaluation, record keeping, notification of the investigator and/or veterinarian and persons responsible for euthanasia. Checklists/ score sheets may be helpful in ensuring appropriate observations are made, consistently interpreted, and properly documented.

Death or Moribundity

While it is preferable to use the earliest endpoints compatible with the scientific requirements of each study, there are studies that require moribundity or mortality as an endpoint. The moribund condition is defined as a clinically irreversible condition leading inevitably to death. In these studies, animals are permitted to die or become moribund, as a result of experimental procedures. In some cases, pain relieving measures are not used because such measures may compromise the experimental integrity of the study. Examples of research proposals that may have death or moribundity as an endpoint include: infectious disease studies, drug and toxicity studies, and cancer research. The following guidelines are suggested to assist the IC Animal Care and Use Committees in reviewing proposals with death or moribundity as endpoints.

Animal Study Proposals utilizing death or moribundity as an endpoint should contain the following information:

1.The scientific rationale for death or moribundity as an endpoint, including:

A. What alternatives were considered, why morbidity as an endpoint cannot be used, and how alternatives will be used whenever possible.

B. Why pain relieving measures cannot be utilized.

C. Number of animals to be used and why this is the minimal number of animals required.

D. Whether animals will be euthanized when moribund and if not, what information is to be gained in the interval between moribundity and death.

2. A plan for the following animal care and monitoring procedures:

A. Animals involved in experiments that may lead to moribundity or death will be monitored daily by personnel experienced in recognizing signs of morbidity (illness, injury, or abnormal behavior) for at least the following: abnormal posture, rough hair coat, head tucked into abdomen, exudate around eyes and/ or nose, skin lesions, or abnormal breathing, difficulty with ambulation, decreased food or water intake, or self mutilation.

B. The frequency of observation will be increased when animals exhibit the above or other signs of moribundity. Monitoring on weekends and holidays may require involvement of the investigative staff to supplement that provided by the animal care and veterinary staff. Designated personnel, including a veterinarian, should be notified as soon as animals show signs of disease. An assessment of the animals' condition should be made as soon as possible and a plan of action established.

C. Consideration will be given to moving animals to individual cages when their condition deteriorates to the point that injury from other animals is likely. Dead animals must be promptly removed.

D. Written records will be kept of monitoring.

General endpoint references

Canadian Council on Animal Care (1998), Guidelines on: choosing an appropriate endpoint in experiments using animals for research, teaching and testing. Ottawa, Canada.

Hendriksen and Morton, ed. (1998), Humane Endpoints in Animal Experiments for Biomedical Research. Proceedings of the International Conference, 22-25 November 1998, Zeist, The Netherlands. Laboratory Animals Ltd, by Royal Society of Medicine Press Limited, London, England.

Institute for Laboratory Animal Research Journal (2000), Humane Endpoints for Animals Used in Biomedical Research and Testing. 41: No. 2

Morton and Griffiths (1985), Veterinary Record 116:431-43.

Montgomery (1990), Cancer Bulletin 42:230-237.

Toth (1997), Contemporary Topics 36:44-48.

Stokes (1999) Humane Endpoints in Animal Experiments for Laboratory Animals Used in Toxicity Testing. Proceedings of the 3rd World Congress on Alternatives and Animal use in the Life Sciences, 31 August - 2 September 1999, Bologana, Italy.

United Kingdom Co-ordinating Committee on Cancer Research (1997), UKCCCR Guidelines for the Welfare of Animals in Experimental Neoplasia, 2nd ed. London, England.

Tumor size references

Bullard et al. (1981), J. Neuropath. Exp. Neurol. 40:410-427.

Tomayko and Reynolds (1989), Cancer Chemother. Pharmacal. 24:148-154.

Sung et al. (1993), Cancer Research 53: 2092-2099.

Welch et al. (1994), Oncogene 9:255-262.

Hamm (1995), Contemporary Topics 34:69-71.

Guidelines for the Euthanasia of Mouse and Rat Fetuses and Neonates

These guidelines were revised and reapproved on November 10, 1998 by the National Institutes of Health Animal Research Advisory Committee and are available at http://oacu.od.nih.gov/ARAC/documents/Rodent_Euthanasia_Pup.pdf

The Report of the AVMA Panel on Euthanasia does not provide specific recommendations for the euthanasia of prenatal or neonatal animals. The following guidelines are suggested to assist individual Animal Care and Use Committees at the NIH in reviewing proposals which involve the use of rodent fetuses or neonates.

Fetuses:

1. Fetuses up to 14 days in gestation: Neural development at this stage is minimal and pain perception is considered unlikely. Euthanasia of the mother or removal of the fetus should ensure rapid death of the fetus due to loss of blood supply and non-viability of fetuses at this stage of development.
2. Fetuses 15 days in gestation to birth: The literature on the development of pain pathways suggests the possibility of pain perception at this time. Whereas fetuses at this age are not sensitive to inhalant anesthetics, euthanasia may be induced by the skillful injection of chemical anesthetics. Decapitation with surgical scissors, cervical dislocation, or rapid freezing (immersion in liquid nitrogen) are acceptable physical methods of euthanasia. When chemical fixation of the whole fetus is required, fetuses should be anesthetized prior to immersion in or perfusion with fixative solutions. Anesthesia may be induced by hypothermia (1) of the fetus, by injection of the fetus with a chemical anesthetic, or by deep anesthesia of the mother with a chemical agent that crosses the placenta, e.g., pentobarbital. The institute veterinarian should be consulted for considerations of fetal sensitivity to specific anesthetic agents. When fetuses are not required for study, the method chosen for euthanasia of a pregnant mother must ensure rapid death of the fetus.

Neonates:

a. Up to 14 days of age: Acceptable methods for the euthanasia of neonatal mice and rats include: injection of chemical anesthetics (e.g., pentobarbital), decapitation, or cervical dislocation. Additionally, these animals are sensitive to inhalant anesthetics; e.g., methoxyflurane (used with appropriate safety considerations). Immersion in liquid nitrogen may be used only for newborns; pups older than one day should be anesthetized prior to freezing with liquid nitrogen. Similarly, anesthesia should precede immersion or perfusion with chemical fixatives. Anesthesia may be induced by inhalant or injectable anesthetics; the institute veterinarian should be consulted for appropriate agents and dosages. Alternatively, when adequately justified, hypothermia1 may be used to induce

anesthesia in pups six days of age or less.

b. Older than 14 days: Follow guidelines for adults.

In all cases, the person performing the euthanasia must be fully trained in the appropriate procedures.

(1) Phifer, C.B. and Terry, L.M. 1986. Use of hypothermia for general anesthesia in preweanling rodent. Physiol. & Behav. 38:887-890.

Bibliography

Amyx, H.L. (1987). **Alternatives to the LD-50 in infectious disease studies.** *Scientists Center for Animal Welfare Newsletter* 9(4): 1-2.
NAL call number: QL55 N48
Descriptors: reducing animal numbers, preventing pain, infectious dose 50, incubation time interval assay, alternatives, humane endpoints, infectious diseases, titration of infectious agents in live animals, diagnostic tools, clinical signs of disease.

Amyx, H.L. (1987). **Control of animal pain and distress in antibody production and infectious disease studies.** *JAVMA* 191(10): 1287-1289.
NAL call number: 41.8 Am3
Descriptors: Freund's complete adjuvant, alternative adjuvants, minimization of side-effects of Freund's by careful control of injection quantity and injection site selection, rabbits, inappropriate to use Freund's in feet of rabbits, rodent footpad injections, ascites, pristane, restraint methods, animal care personnel, principles for control of pain and distress, humane endpoints, monitoring health of animals, euthanasia, analgesics, experimental design, rodents, dogs, cats, primates.

Blogg, S.L., P.P. Townsend, P.J. Butler, and E.W. Taylor (1998). **A method of anaesthesia and post-operative care for experimental procedures in avian species.** *Animal Technology* 49(2): 101-109.
NAL call number: QL55 I5
Abstract: This paper describes a successful method of anaesthesia for prolonged and/or invasive avian surgery, along with an appropriate protocol for post-operative care. These methods were determined during a neuroanatomical study of two species of bird, the tufted duck (*Aythya fuligula*) and the domestic duck (*Anas platyrhynchos*), as part of an ongoing scientific study. Descriptions of current, relevant techniques of anaethesia suitable for this study, were not readily available, therefore we felt that details of our methods would be a valuable contribution to this field. A standard operating procedure for use in similar studies and an example of an avian post-operative score sheet are outlined.

Browder, E.J. (1995). **Death as an endpoint.** In *Current Issues and New Frontiers in Animal Research*, K.A.L. Bayne, M. Greene, and E.D. Prentice, (eds.), Greenbelt, Maryland: Scientists Center for Animal Welfare, pp. 25-29.
NAL call number: HV4913 C87 1995
Descriptors: LD50, scientific justification, humane endpoints, assessment of animals, temperature drop, rectal temperature, IACUC responsibilities, investigator responsibilities, animal care staff responsibilities, funding agency responsibilities, data collection, assessment of pain and distress, selected criteria for euthanasia of moribund animals.

Canadian Council on Animal Care (1999). ***CCAC guidelines on: Choosing an appropriate endpoint in experiments using animals for research, education, and testing.*** Ottawa, Ontario,Canada: Canadian Council on Animal Care.
Available at http://www.ccac.ca/Documents/Standards/Guidelines/Appropriate_endpoint.pdf
Descriptors: animal observation, significant indicators of pain and distress, scoring significant behavioral and physiological observations to set endpoints, pilot studies to determine appropriate endpoint, determining frequency of observations, defining responsibility for observations, training personnel in clinical animal observations, role of the

IACUC, monoclonal antibody production, cancer research, toxicology, pain research, infectious disease studies, vaccine trials, animal models with potential for significant levels of pain and distress, species specific signs of pain and distress, information sources, understanding normal animal behavior, recognition and assessment of pain and distress, laboratory animals, fish, farm animals, examples of observational checklists used to determine endpoints.

Coenen, A.M.L., W.H.I.M. Drinkenburg, R. Hoenderken, and E.L.J.M. van Luijtelaar (1995). **Carbon dioxide euthanasia in rats: oxygen supplementation minimizes signs of agitation and asphyxia.** *Laboratory Animals* 29(3): 262-268.
NAL call number: QL55.A1L3
Descriptors: experimental methods, behavior, electroencephalogram (EEG), electrocardiogram (ECG), effect of method-animals added to a box: completely filled with CO_2, into which CO_2 was streamed at a high flow rate, into which CO_2 was streamed at a low flow rate, into which a mixture of CO_2 and O_2 was streamed at a fast rate, negative aspects of CO_2 euthanasia can be prevented by an additional supply of oxygen.

Close, B., K. Banister, V. Baumans, E-M. Bernoth, N. Bromage, J. Bunyan, W. Erhardt, P. Flecknell, N. Gregory, H. Hackbarth, D. Morton, and C. Warwick (1997). **Working party report: Recommendations for euthanasia of experimental animals: Part 2.** *Laboratory Animals* 31(1): 1-32.
NAL call number: QL55.A1L3
Descriptors: This document was prepared for the European Commission to be used with Directive 86/609/EEC on animal welfare, excellent review of methods of euthanasia for fish, amphibians, reptiles, birds, rodents, rabbits, carnivores (dogs, cats, ferrets), large mammals (pigs, sheep, goats, cattle, horses), nonhuman primates, less commonly used species, each section includes information on overview of the species, recognition and confirmation of death, how to euthanize larvae or embryos, physical methods, chemical methods, unacceptable methods of euthanasia.

Cunningham, J.J. and D.C. Priddy (1999). **A low-cost chamber for rodent CO_2 euthanasia.** *Lab Animal* 28(2):44-45.
NAL call number: QL55.A1L33
Descriptors: euthanasia, technique, low-cost method, humane.

Danneman, P.J., S. Stein, and S.O. Walshaw (1997). **Humane and practical implications of using carbon dioxide mixed with oxygen for anesthesia or euthanasia of rats.** *Laboratory Animal Science* 47(4): 376-385.
NAL call number: 410.9 P94
Abstract: A series of studies was undertaken to determine whether CO_2 can be used as a humane as well as practical agent for euthanasia or anesthesia of rats. Human volunteers rated the degree of discomfort associated with breathing 50 to 100% CO_2 mixed with oxygen. Increasing concentrations of CO_2 were judged as progressively more noxious, from "highly unpleasant" for 50% CO_2 to "painful" for 100% CO_2. The practical aspects of anesthesia and euthanasia with 50 to 100% CO_2 were studied, using male Sprague Dawley rats. Time to anesthesia and death were inversely related to CO_2 concentration, as were the frequency and severity of adverse reactions, including seizures and hemorrhaging from the nose. The severity of edema and hemorrhage, which were observed on histologic examination of the lungs of all rats euthanized with CO_2, were greatest in the animals exposed to the lowest concentrations. There were no significant effects of CO_2 concentration on time to recumbency or recovery, and there were no significant effects of precharging versus not precharging the chamber on any of the parameters studied. It was concluded that, although CO_2 can be used in a humane manner, the concentrations that are least likely to cause pain and distress are associated with the longest times to anesthesia and death, highest incidence of unwanted side effects, and most severe histologic changes in the lungs. Acceptably humane and reasonably practical euthanasia or anesthesia can be achieved using a nonprecharged chamber and a low gas flow rate so that conscious animals are never exposed to CO_2 concentrations >70%.

Flecknell, P. (1997). **Avoidance and alleviation of pain and distress.** In *Animal alternatives, welfare, and ethics, Proceedings of the 2nd World Congress on Alternatives and Animal Use in the Life Sciences, held in Utrecht, the Netherlands, 20-24 October 1996,* L.F.M. Zutphen and M. Balls (eds.), Amsterdam, New York: Elsevier, pp. 241-245.
NAL call number: QL1.D48 v.27

Descriptors: pain assessment, animal behavior, terminal anesthesia, analgesics, anxiolytics, humane endpoints, housing, animal husbandry.

Flecknell, P. (1997). **Medetomidine and atipamezole: Potential uses in laboratory animals.** *Lab Animal* 26(2): 21-25.
NAL call number: QL55.A1L33
Descriptors: pharmacology, clinical uses, sedation, anesthesia, tables of suggested doses for cats, dogs, gerbils, guinea pigs, ferrets, hamsters, mice, pigs, rabbits, rats, sheep, marmosets, anesthetic combinations.

Foltz, C.J. and M. Ullman-Cullere (1999). **Guidelines for assessing the health and condition of mice.** *Lab Animal* 28(4): 28-32.
NAL call number: QL55.A1L33
Descriptors: transgenic mice, knockout mice, potentially debilitating phenotypes, humane endpoints, monitoring criteria, communications between veterinary staff and investigators, body condition scoring, health guidelines, barbering, fighting, malocclusion, rectal prolapse, tumors and masses, ulcerative dermatitis, vaginal or uterine prolapse, subtle health problems - activity/behavior, anemia, dehydration, diarrhea, hypothermia, preputial or vaginal discharge, additional health problems - abnormal breathing, abnormal locomotion, eye abnormality, head tilt, hyperactivity, lethargy, paresis, paralysis, ruffled fur, tremors.

Gentle M.J. (1992). **Pain in birds.** *Animal Welfare* 1(4): 235-247.
NAL call number: HV4701.A557
Descriptors: poultry, recognition and assessment of pain, nociceptors, behavioral and physiological responses to nociceptive stimulation, pain following trauma, animal welfare, debeaking, analgesics, pain, trauma, reviews.

Hamm, T.E. Jr. (1995). **Proposed institutional animal care and use committee guidelines for death as an endpoint in rodent studies.** *Contemporary Topics in Laboratory Animal Science* 34 (3): 69-71.
NAL call number: SF405.5.A23
Descriptors: laboratory animals, endpoints, animal welfare, committees, guidelines, rodents, death, regulations.

Hellyer, P. (1998). **American College of Veterinary Anesthesiologists' position paper on the treatment of pain in animals.** *Journal of the American Veterinary Medical Association* 213 (5): 628-630.
NAL call number: 41.8 Am3
Descriptors: animal welfare, pain, symptoms, treatment, anesthesia.

Jones, D.M. (1999). **Carbon dioxide induced anesthesia has no effect on brain biogenic amine concentrations in mice.** *Laboratory Animal Science* 49(3): 316-318.
NAL call number: 410.9 P94
Descriptors: humane death, norepinephrine, dopamine, serotonin, cortex, hippocampus, striatum, cerebellum, decapitation.

Kallman, R.F., J.M. Brown, J. Denekamp, R.P. Hill, J. Kummermehr, and K.-R. Trott (1985). **The use of rodent tumors in experimental cancer therapy. Conclusions and recommendations from an international workshop.** *Cancer Research* 45: 6541-6545.
NAL call number: 448.8 C16
Descriptors: tumor/host systems, model systems, tumor immunogenicity, host animals, assay procedures, tumor growth delay assay, cellular survival assays following excision, experimental variables that can affect assay procedures or the interpretation of results, animal health and husbandry, site of tumor implantation, tumor size, stress, anesthesia, hypothermia, experimental design, radiation exposure time, cell cycle effects, drug resistance, combined modality experiments, models for adjuvant therapy, ethical principles, tumors should not exceed 10 percent of body weight.

Kastello, D.A. (1990). **Recognition and alleviation of pain and distress.** *Symposium: Animal Welfare Compliance for Study Directors* Orlando, Florida: American College of Toxicology.
NAL call number: Videocassette no. 968
Descriptors: study director, veterinarian, ACUC, pain, humane endpoints.

Keefe, F.J., R.B. Fillingim, and D.A. Williams (1991). **Behavioral assessment of pain: Nonverbal measures in animals and humans.** *ILAR News* 33(1-2): 3-13.
NAL call number: QL55.A1I43
Descriptors: excellent review of pain induction methods for analgesia testing, tail flick, hot plate, flinch-jump, pinch, formalin, chronic pain paradigms, pain measurement methods, quantification of presence of analgesia, animals, humans, devices, observation methods.

Koolhaas J.M., V. Baumans, H.J.M. Blom, D. Holst von, P.J.A. Timmermans, P.R. Wiepkema, D. Von Holst, L.F.M. Zutphen van (ed.), V. Baumans (ed.), and A.C. Beynen (1993). **Behaviour, stress and well-being.** In *Principles of laboratory animal science: A contribution to the humane use and care of animals and to the quality of experimental results.* L.F.M. van Zutphen, V. Baumans, and A.C. Beynan (eds.), Amsterdam: Elsevier Science Publishers, pp. 75-99.
NAL call number: QL55.P762 1993
Descriptors: laboratory animals, animal experiments, adaptation, learning, environment, physiology, animal behaviour, animal welfare, stress, homeostasis, phylogeny, learning, ontogeny, interaction between animal and its environment, interaction between environment and physiology, autonomic nervous system, neuroendocrine system, functional significance of physiological stress responses, pathophysiology, well-being.

Kort,W.J., J.M. Hekking-Weijma, M.T. TenKate, V. Sorm, and R. van Strik (1998). **A microchip implant system as a method to determine body temperature of terminally ill rats and mice.** *Laboratory Animals* 32(3): 260-269.
NAL call number: QL55.A1L3
Abstract: *Klebsiella pneumoniae* was inoculated intratracheally into rats and mice, and the temperature of the animals was recorded twice daily using microchip transponders (ELAMS) implanted either s.c. or i.p. The microchip temperatures were compared with rectal temperatures taken at the same time. The results showed that ELAMS was easy to operate and there were no important drawbacks in the use of the system were observed. The temperatures measured by the transponders implanted s.c. and i.p. did not differ significantly from rectal temperatures. In 2 out of 3 experiments on rats, it was shown that when the temperatures reached values below 36°C, the median survival time of the animals was 24 h. In an experiment on mice, the same median survival time was observed at 36°C. In 1 experiment using rats, however, the disease was so acute that death occurred before any temperature drop. It is suggested that when a 36° C cutoff point is used instead of the time of death in this particular animal model, the statistical analysis is not altered, and it may spare animals further suffering for approximately 24 h. It is concluded that the ELAMS system of monitoring body temperature is simple and relatively stress free for laboratory animals.
Descriptors: body temperature, monitoring, microchips, transponders, animal welfare, experimental infectious diseases.

Liles, J.H. and P.A. Flecknell (1992). **The use of non-steroidal anti-inflammatory drugs for relief of pain in laboratory rodents and rabbits.** *Laboratory Animals* 26(4): 241-255.
NAL call number: QL55.A1L3
Descriptors: classification of non-opioid non-steroidal analgesics, pharmacology of NSAIDs, assessment of analgesic efficacy, thermal stimulus, electrical stimulus, chemical methods, mechanical forces, edema tests, analgesiometry and clinical pain, effective analgesic and lethal doses of NSAIDS in mice, adverse effects of NSAIDS and selection of dose rates, analgesic, anti-inflammatory, and lethal doses in rats, ulcerogenic doses in rats, use of NSAIDS in humans and animals, suggestions for uses in laboratory animals.

Louie, A., W. Liu, Q.F. Liu, A.C. Sucke, D.A. Miller, A. Battles, and M.H. Miller (1997). **Predictive value of several signs of infection as surrogate markers for mortality in a neutropenic guinea pig model of *Pseudomonas aeruginosa* sepsis.** *Laboratory Animal Science 47(6): 617-623.*
NAL call number: 410.9 P94
Abstract: Infected, neutropenic animals are used as experimental models to evaluate the relative efficacies of antimicrobial agents and host-pathogen-antibiotic interactions. In the past, these models used death as the study end point. Because of the concern about use of death as an end point, we evaluated the accuracy with which various signs of infection predicted mortality in a neutropenic guinea pig model of treated and untreated *Pseudomonas aeruginosa* sepsis. The potential surrogate markers studied included ruffled fur, respiratory distress, diarrhea, hunched posture, lethargy, abnormal neurologic movements (twitching, paralysis of a limb), inappetence for > 48 h, the inability to ambulate, and the inability of a supine animal to stand. In addition, we evaluated whether percentage of weight loss or change in daily food and water consumption were predictive of mortality. Animals were inspected for these signs at

least every 4 h during the day and every 8 h in the evening. In treated and untreated animals, 100% of subjects that were unable to ambulate or to rise from the supine position died (positive predictive value for death was 100% for either sign). Guinea pigs that could not rise from a supine position expired between 1 and 8 h after this sign was observed. Those that could not ambulate died between 4 and 40 h after that sign was observed. In treated, and untreated animals, none of the survivors manifested either sign of disease (100% specificity for each sign). However, 59% of untreated and 69% of treated animals that were ambulatory were found dead at the next observation period, underscoring the rapidity with which this infection progresses to death when it enters its final stage. No other signs of infection distinguished animals that survived or died. Thus, the inability of neutropenic, infected guinea pigs to rise from a supine position and the inability to ambulate were the only signs that accurately predicted death and, therefore, are the only signs that can be used as surrogates for death in this experimental model of *P. aeruginosa* sepsis.
Descriptors: animal models, *Pseudomonas aeruginosa*, sepsis, surrogate markers, mortality prediction, weight losses, food intake, water intake, imipenem, tobramycin, ceftazidime, antibiotics, humane endpoints.

Montgomery, C.A. (1987). **Control of animal pain and distress in cancer and toxicological research.** *JAVMA* 191(10): 1277-1281.
NAL call number: 41.8 Am3
Descriptors: experimental design, choice of rodent strain, statistical assessment of studies, animal husbandry and disease control, housing and bedding, conduct and interpretation of a study, selected clinical observations used in toxicologic studies, route of chemical administration, selected criteria for euthanasia of moribund animals, veterinary care, training.

Morton, D.B. (1998). **The recognition of adverse effects on animals during experiments and its use in the implementation of refinements.** In *Proceedings of the Joint ANZCCART/ NAEAC conference on Ethical Approaches to Animal-based Science*, D. Mellor, M. Fisher, and G. Sutherland (eds.), Adelaide, Australia and Wellington, New Zealand: ANZCCART, pp. 61-67.

Morton, D.B. (1998). **The use of score sheets in the implementation of humane end points.** In *Proceedings of the Joint ANZCCART/ NAEAC conference on Ethical Approaches to Animal-based Science*, D. Mellor, M. Fisher, and G. Sutherland (eds.), Adelaide, Australia and Wellington, New Zealand: ANZCCART, pp. 75-82.

Morton, D.B. (1997). **A scheme for the recognition and assessment of adverse effects in animals.** In *Animal alternatives, welfare, and ethics, Proceedings of the 2nd World Congress on Alternatives and Animal Use in the Life Sciences, held in Utrecht, the Netherlands, 20-24 October 1996*, L.F.M. Zutphen and M. Balls (eds.), Amsterdam, New York: Elsevier, pp. 235-240.
NAL call number: QL1.D48 v.27
Descriptors: husbandry and experimental techniques, score sheets, body weight, activity, temperature, vocalization, abdominal distension, palpate, sunken eyes, dehydration, breathing, observation, humane endpoints.

Morton, D.B. and Griffiths, P.H.M. (1985). **Guidelines on the recognition of pain, distress, and discomfort in experimental animals and an hypothesis for assessment.** *Veterinary Record* 116(16): 431-436.
NAL call number: 41.8 V641
Descriptors: signs of pain, distress, and discomfort, aids in their interpretation, appearance, food and water intake, behavior, clinical signs, cardiovascular, respiratory, digestive, nervous and musculoskeletal, temperature, edema, swelling, discharges, urinary changes, quantitative assessment of pain, distress, and discomfort, bodyweight, relationships between signs and degree of pain, distress, and discomfort, interpretation of scoring from an overall assessment, species specific clinical signs indicating pain, rats, mice, rabbits, guinea pigs, dogs, cats, primates.

National Research Council (1992). ***Recognition and Alleviation of Pain and Distress in Laboratory Animals.*** Washington, D.C.: National Academy Press, 137 p.
NAL call number: SF996.5.R43 1992
Descriptors: biologic importance of pain and distress, stressors, distress models, basis of pain, basis of stress and distress not induced by pain, recognition and assessment of pain, stress and distress, control of pain, control of stress and distress, euthanasia.

Phifer, C.B. and L.M. Terry (1986). **Use of hypothermia for general anesthesia in preweanling rodents.** *Physiology and Behavior* 38(6): 887-890.
NAL call number: QP1.P4
Descriptors: rationale and background, techniques used to induce hypothermia, deep hypothermia for surgical manipulations, moderate hypothermia as adjunct, applications.

Raufer B. and M. Miller (1997). **Euthanasia: an animal-care protocol.** *Pork* 17(2): 32-37.
Descriptors: techniques, pain, euthanasia, animal welfare.

Redgate, E.S., M. Deutsch, and S.S. Boggs. **Time of death of CNS tumor-bearing rats can be reliably predicted by body weight-loss patterns.** *Laboratory Animal Science* 41(3): 269-273.
NAL call number: 410.9 P94
Descriptors: ACUC, central nervous system, antineoplastic drug, moribund state, alternative to death as endpoint, tumor growth, neoplasms.

Rockwell, S. (1987). **Maintenance of tumor systems and appropriate treatment techniques for experimental tumors.** In *Rodent Tumor Models in Experimental Cancer Therapy*, R.F. Kallman, ed., Elmsford, New York: Pergamon Press, pp.29-36.
NAL call number: RC261.A2R62
Descriptors: choice and maintenance of animals, effect of pathogenic microorganisms, contamination of personnel, appropriate treatment techniques, choice of appropriate tumor, effects of anesthesia and restraint, tumor size-a 200mm^2 (about 3/8 inch X 3/4 inch) tumor in a 20-25 (about 1 ounce) gram mouse is roughly equivalent to a 600 gram (1 pound 5 ounces) tumor in a 60-75 kg (132-165 pounds) patient, effects of stress, induction of tumor hypoxia, host-mediated effects.

Rollin, B.E. (1997). **Pain and ideology in human and veterinary medicine.** *Seminars in Veterinary Medicine and Surgery (Small Animals)* 12(2): 56-60.
Descriptors: animal welfare, philosophy, analgesics, anesthetics, pain.

Siems, J.J. and Allen, S.D. (1989). **Early euthanasia as an alternative to death in chronic infectious disease studies using a systemic *Candida albicans* model.** *Abstracts of the 89th Annual Meeting of the American Society for Microbiology* 1989: 81 (B-304).
NAL call number: QR1.A5
Descriptors: humane endpoints, predicting time of animal's death, multiple regression analysis, use of variables, weight loss, temperature drop, tenting-an indicator of dehydration, ataxia, rough hair coat, assessment of animal conditions throughout experiment, prevention of post-mortem change of tissues and body fluids.

Shipp, K. and B.D. Woodward (1998). **A simple exsanguination method that minimizes acute pre-anesthesia stress in the mouse: evidence based on serum corticosterone concentrations.** *Contemporary Topics in Laboratory Animal Science* 37(5): 73-77.
NAL call number: SF405.5.A23
Descriptors: stress, anesthesia, corticosterone, blood collection, inhalation anesthetics, animal welfare, carbon dioxide.

Soma, L.R. (1987). **Assessment of animal pain in experimental animals.** In *Effective Animal Care and Use Committees*, F.B. Orlans, R.C. Simmonds, and W.J. Dodds (eds.), 71-74. Special Issue of Laboratory Animal Science, Bethesda, Maryland: Scientists Center for Animal Welfare, pp.71-74.
NAL call number: QL55.E4
Descriptors: pain responses of animals, surgical procedures, postoperative pain, procedures likely to require analgesics or sedatives, clinical assessment of pain, chronic pain, chronic illness.

Soothill, J.S., Morton, D.B., and Ahmad, A. (1992). **The HID-50 (hypothermia inducing dose 50): An alternative to the LD-50 for measurement of bacterial virulence.** *International Journal of Experimental Pathology* 73: 95-98.
Descriptors: rectal temperature, temperature drop, prediction of time of death, humane endpoint, euthanasia, alternatives.

Svendsen, P. and C. Rasmussen (1998). **Anaesthesia of minipigs and basic surgical techniques.** *Scandinavian Journal of Laboratory Animal Science* 25(SUPP 1): 31-43.
NAL call number: QL55.S322
Descriptors: miniature pigs, surgery, anesthesia, methods.

Tomasovic, S.P., Coghlan, L.G, Gray, K.N., Mastromarino, A.J., and Travis, E.L. (1988). **IACUC evaluation of experiments requiring death as an endpoint: A cancer center's recommendations.** *Lab Animal* 17(1): 31-34.
NAL call number: QL55.A1L33
Abstract: IACUCs in some institutions face special problems with protocols in which death is the required end point. A possible alternative in some cases may be euthanasia when the animals become moribund.

Townsend, P. (1993). **Control of pain and distress in small laboratory animals.** *Animal Technology* 44(3): 215-223.
NAL call number: QL55.I5
Abstract: The prevention and alleviation of pain and distress in laboratory animals is presented as a strategy incorporating management, animal husbandry and scientific techniques, involving all those concerned with animal care and use, including animal technicians, veterinary surgeons and scientists. The paper identifies causes of pain and distress throughout the experimental animals life and attempts to highlight practical ways of preventing or, if this is not possible, alleviating any pain or distress which the animal may endure. All of the strategies involve making the laboratory animal the focus of concern when designing experimental schedules, as the prevention of pain and distress is the first step to producing good science.
Descriptors: distressful situations-fear, loneliness, boredom, preemptive control-planning for avoidance, refinement of techniques to minimize discomfort, alleviation of pain, anesthesia, analgesia, review of drugs, humane endpoints, euthanasia, examples of score sheets.

Toth, L.A. (1997). **The moribund state as an experimental endpoint.** *Contemporary Topics in Laboratory Animal Science* 36(3): 44-48.
NAL call number: SF405.5.A23
Descriptors: pain scoring, distress, suffering in animals, experimental paradigms, use of objective information to predict death, humane endpoints, use of experimentally relevant clinical signs, body weight, body temperature, euthanasia.

Ullman-Culleré, M.H. and C.J. Foltz (1999). **Body condition scoring: A rapid and accurate method for assessing health status in mice.** *Laboratory Animal Science* 49(3): 319-323.
NAL call number: 410.9 P94
Descriptors: noninvasive methods, criteria for euthanasia, emaciation, underconditioned, well-conditioned, overconditioned, obese, tumors, aging studies.

United Kingdom Co-ordinating Committee on Cancer Research (UKCCCR) Guidelines for the Welfare of Animals in Experimental Neoplasia (Second Edition) (1998). *British Journal of Cancer* 77(1): 1-10.
Descriptors: animal welfare; experimental neoplasms, research design, analgesia, animal growth and development, disease models, gene therapy, neoplasm transplantation, neoplasms physiopathology, neoplasms, therapy, humane endpoints.

Van Loo, P.L.P., L.A. Everse, M.R. Bernsen, V. Baumans, L.J. Hellebrekers, C.L.J.J. Kruitwagen, and W.den Otter (1997). **Analgesics in mice used in cancer research: reduction of discomfort?** *Laboratory Animals* 31(4): 318-325.
NAL call number: QL55.A1L3
Descriptors: animal behavior, exploration, grooming, posture, food and water consumption, buprenorphine administered in Jello, chronic pain, advanced tumors, study could not document a positive effect of buprenorphine on discomfort, possible explanations are examined.

Wallace, J., J. Sanford, M.W. Smith, and K.V. Spencer (1990). **The assessment and control of the severity of scientific procedures on laboratory animals.** *Laboratory Animals* 24: 97-130.
NAL call number: QL55.A1L3
Descriptors: definitions of severity, assessment of severity, components, index of severity, identifying and scoring pain, control of the severity of scientific procedures, development of a program for control, management practices, training,

animal husbandry, humane and experimental endpoints, behavioral changes, psychosocial influences, diseases, euthanasia, sensitivity of tissues and organs to challenges, recognition and assessment of pain and distress, potential responses and physiological signs are provided for the following species: mouse, guinea pig, rabbit, golden hamster, and gerbil, comprehensive indices of severity of scientific procedures are provided for administration of substances, collection of tissue and body fluids, surgical techniques, and restraint.

Wright, A.J. and R.J. Phillpotts (1998). **Humane endpoints are an objective measure of morbidity in Venezuelan encephalomyelitis virus infection of mice.** *Archives of Virology* 143(6): 1155-1162.
NAL call number: 448.3 Ar23
Descriptors: acute infection, symptoms, clinical aspects, animal welfare, equine encephalomyelitis virus, humane endpoints.

Useful World Wide Web Sites

American Veterinary Medical Association Panel on Euthanasia Report, 2000
http://www.aphis.usda.gov/ac/euthanasia.pdf
Euthanasia methods approved by the AVMA and referenced by USDA and PHS.

Assessment of Pain and Distress in Laboratory Animals
http://www.ahc.umn.edu/rar/pain&distress.html
Provided by Research Animal Resources, University of Minnesota

That Have the Potential To Cause Severe Or Chronic Pain or Distress
http://www.iacuc.emory.edu/documents/endpoints.pdf
Provided by Emory University

Guidelines For Endpoint Monitoring And Humane Termination
http://labanimals.stanford.edu/guidelines/endpoint.html
Provided by the Dean of Research, Stanford University

Guidelines on Death as an Endpoint
http://www.upstate.edu/iacuc/pdf/euthanasia_1_deathasendpoint.pdf
Provided by Department of Laboratory Animal Resources at State University of New York-Health Sciences Center in Syracuse, NY.

IACUC and Pain-Related Internet Resources
http://netvet.wustl.edu/pain.htm
Approximately 400 web-based resources relevant to pain or IACUC's are referenced. This collection of links attempts to provide those interested with an overview of some of the best information currently available on the Internet. The categories of resources listed include: major neuroscience directories, resource references, journals, meetings, government agencies and regulations, anesthesia and analgesia, academic departments, institutional animal care and use committees, animal behavior, ethics and alternatives to animal testing, commercial resources, as well as pain societies and animal research organizations.

Updated June 18, 2014

Farm Animals

- Welfare Concerns for Farm Animals Used in Agricultural and Biomedical Research and Teaching
  (links to the article previously published in the Animal Welfare Information Center Newsletter)

- Recognition of Pain in Farm Animals
  (links to the article previously published in the Animal Welfare Information Center Newsletter **scroll down to article**)

- Large Animals Anesthesia
  (links to the article previously published in the Animal Welfare Information Center Newsletter **scroll down to article**)

- Post-Operative Care and Analgesia of Farm Animals Used in Biomedical Research
  (links to the article previously published in the Animal Welfare Information Center Newsletter **scroll down to article**)

- Agricultural Animal Care Review
  (links to the article previously published in the Animal Welfare Information Center Newsletter **scroll down to article**)

  See also Preparing the Farm and Farm Animals for Disasters in the section Disaster Planning

- Bibliography

- Useful World Wide Web Sites

Bibliography

Anderson, D. L. (1993). ***Handbook of Live Animal Transport.***
NAL call number: HV4733.H36 1993
Descriptors: Animal welfare, animal handling and safety, veterinary procedures, animal health regulations, transporting animals by land, sea and air, exporting animals.

Bath, G.F. (1998). **Management of pain in production animals.** *Applied Animal Behaviour Science* 59(1-3): 147-156.
NAL call number: QL750.A6
Descriptors: animal welfare, pain management, evaluation, animal production, animal behaviour, cattle, pigs, sheep.

Boer, I.J.M. de., F.W.A. Brom, and J.M.G. Vorstenbosch (1995). **An ethical evaluation of animal biotechnology: the case of using clones in dairy cattle breeding.** *Animal Science: An International Journal of Fundamental and Applied Research* 61(pt.3): 453-463.
NAL call number: SF1.A56
Descriptors: dairy cattle, bioethics, moral values, biotechnology, cloning, animal welfare, genetic variation, artificial insemination, personal development.

Craig, J.V. and J.C. Swanson (1994). **Review: welfare perspectives on hens kept for egg Production.** *Poultry Science* 73 (7): 921-938.
NAL call number: 47.8 Am33P
Abstract: Welfare issues relative to egg-laying hens are addressed in terms of historical developments and current concerns. Ethical perspectives, attitudes, and public opinion of the past and present are reviewed. Indices of hens' well-being and what those reveal about alternative husbandry practices and production systems are presented along with estimates of economic consequences of alternative systems of table egg production. Possibilities of genetic selection to reduce welfare-related problems are discussed.
Descriptors: hens, animal welfare, battery husbandry, animal behavior, stress, public opinion, floor husbandry, stocking density, chicken housing, bone strength, production costs, selection responses, domestication, literature reviews.

Cunningham, D.L. and J.M. Mauldin (1996). **Cage housing, beak trimming, and induced molting of layers: a review of welfare and production issues.** *Journal of Applied Poultry Research.* 5 (1): 63-69.
NAL call number: SF481.J68
Descriptors: hens, poultry housing, cage density, debeaking, molting, induction, egg production, animal welfare, factory farming.

Cunningham, D.L. (1992). **Beak trimming effects on performance, behavior and welfare of chickens: A Review.** *Journal of Applied Poultry Research* 1 (1): 129-134.
NAL call number: SF481.J68
Descriptors: chickens, debeaking, animal welfare, animal behavior, literature reviews.

Dantzer, R. (1993). **Research perspectives in farm animal welfare: the concept of stress.** *Journal of Agricultural & Environmental Ethics* 6 (special suppl. 2): 86-92.
NAL call number: BJ52.5.J68
Descriptors: livestock, animal welfare, stress, stress factors, animal health, homeostasis, physiopathology.

DeTolla, L.J., S. Srinivas, B.R. Whitaker, C. Andrews, B. Hecker, A.S. Kane, and R. Reimschuessel (1995). **Guidelines for the care and use of fish in research.** *ILAR Journal* 37 (4): 159-173.
NAL call number: QL55.A1I43
Descriptors: fishes, laboratory animals, animal experiments, animal husbandry, animal welfare, medical research, anesthesia, anesthetics, euthanasia, zoonoses, guidelines, regulations.

Ewbank, R. (1993). **Farm animal welfare: a historical overview.** *Journal of Agricultural & Environmental Ethics* 6 (special suppl.1): 82-86.
NAL call number: BJ52.5.J68
Descriptors: livestock farming, animal welfare, ethics, history.

Gonyou, H.W. (1993). **Animal welfare: definitions and assessment.** *Journal of Agricultural & Environmental Ethics* 6 (special suppl.2): 37-43.
NAL call number: BJ52.5.J68
Descriptors: animal welfare, livestock farming, animal behavior, animal physiology, assessment, animal production.

Guttman, H. (1990). **Agricultural Research Service, USDA, publishes new animal care directives.** *Animal Welfare Information Center Newsletter* 1(4):4, 6.
NAL call number: AHV4701.A952
Descriptors: USDA, directives, animal welfare, bioethics, ACUC.

Guttman, H.N. and D.W. Freeman (1996). **Model finfish guidelines based upon use of finfish in research by the Agricultural Research Service/U. S. Department of Agriculture.** *SCAW Newsletter* 18 (1): 9-11.
NAL call number: QL55.N48
Descriptors: fishes, fish culture, animal welfare, regulations, guidelines, USDA, research.

Hartog, L.A. den, H.M. Vermeer, J.W.G.M. Swinkels, N. Verdoes, and G.B.C. Backus (1996). **Applied research on**

new pig housing systems. *Outlook on Agriculture* 25 (4): 257-261.
NAL call number: 10 Ou8
Abstract: Developments in pig housing during the last decade have been influenced not only by economics but also by animal welfare and environmental regulations. Because the different requirements may cause conflicts for some aspects of pig housing, an integrated approach is necessary. Housing systems which partly or fully meet today's animal welfare and environmental regulations in the Netherlands are described.
Descriptors: pig housing, design, animal welfare, environmental protection, applied research, piglets, finishing, lactating females, odor emission, ammonia.

Joiner, G. (1990). **Agricultural animal care review.** *Animal Welfare Information Center Newsletter* 1(4): 3, 5.
NAL call number: aHV4701.A952
Descriptors: livestock, bioethics, animal welfare, ACUC.

Kertz, A.F. (1996). **Animal care and use: an issue now and in the future.** *Journal of Animal Science* 74 (1): 257-261.
NAL call number: 49 J82
Abstract: Animal rights proponents equate human and animal rights or capacity to suffer pain. Animal welfare is a philosophy that centers on animal well-being, a stewardship role that producers view as affecting profitability but the general public may view as having additional components. The agenda of some animal rights proponents may be positioned under the guise of animal welfare to gain acceptability for portions of their work. Currently, guidelines and accreditation programs targeted at ensuring proper animal care and use increasingly include agricultural animals. Also, public initiatives such as the Massachusetts ballot initiative to curtail animal agriculture and the Physicians Committee for Responsible Medicine's attempts to curtail the use of milk and meat in human diets were defeated by educating the general public. Various organizations have been developed to address animal care and use issues. The Animal Industry Foundation is a broad-based agricultural organization addressing animal rights issues. National biomedical organizations, the Foundation of Biomedical Research and the National Association for Biomedical Research, address education and governmental animal rights issues. State-level coalitions. such as those recently organized in Missouri, of agricultural organizations, academic research units, biomedical institutions, and agribusiness or consumer products companies offer great promise of educating others on animals rights and welfare issues. Animal scientists need to educate themselves on these issues, participate in their own institutional Animal Care and Use Committees, and help to educate the general public through organizations and programs at, the local, state, and national level.
Descriptors: animal welfare, animal husbandry, public opinion, animal experiments, consumer education, public relations, meat and livestock industry, dairy industry.

Lund, V. (1997). **Postgraduate teaching in farm animal welfare and ethics.** *Animal Welfare* 6 (2): 105-121.
NAL call number: HV4701.A557
Descriptors: graduate study, livestock, animal husbandry, animal welfare, ethics, surveys.

Mench, J.A., S.J. Mayer, and L. Krulisch (eds.) (1992). ***The well-being of agricultural animals in biomedical and agricultural research. Proceedings from a SCAW sponsored conference, "Agricultural Animals in Research," held September 6-7, 1990, in Washington D.C.*** Bethesda, Maryland: Scientists Center for Animal Welfare, 111p.
NAL call number: HV4704.W38 1990
Descriptors: regulatory perspectives, regulatory issues in experimental surgery in farm animals, stress, behavioral assessment of welfare, social and spacing behavior, handling and transport, minimum stress physical restraint of swine and sheep, cattle workshop-- dehorning, debudding, castration, anesthesia, veal calves, feeding, housing, farm animal husbandry practices, horse workshop-- psychological well-being, food and water requirements, ventilation, space, bedding, shade, poultry workshop-- environmental stressors, euthanasia, cervical dislocation, immunosuppression related to genetic selection for larger birds, leg problems, cardiovascular problems, ascites, lighting, housing, well-being, population density in commercial production, blood collection, infectious disease studies, sheep workshop-- predator control, feedlots, handling, lifetime management, space, housing, respiratory research, zoonotic diseases, feeding, surgical and postsurgical care, raised flooring, swine workshop-- housing, space requirements, farm vs. research setting, farrowing and weaning crates, manure handling, malignant hyperthermia, miniature swine, solitary confinement, transportation, environmental factors.

McGlone, J.J. and T.A. Hicks (1993). **Teaching standard agricultural practices that are known to be painful.**

Journal of Animal Science 71 (4): 1071-1074.
NAL call number: 49 J82
Abstract: Animal science faculty teach, demonstrate, and ask students to perform procedures that are known to be painful. Potentially painful procedures include castration, branding, dehorning, ear notching, teeth clipping, beak trimming, comb and wattle removal, and tail docking. In each case, the degree of pain experienced by an animal is generally not known. Furthermore, the consequences of animals having to endure pain are also not fully understood. A survey was conducted of animal science faculty to identify current departmental policies and practices related to castration in beef and swine production classes. Departments vary in what they require of students. Departments should set a policy to address 1) which (and how) potentially painful procedures are taught and 2) how the faculty deal with students who refuse to participate in putatively painful procedures. The institutional animal care and use committee should approve potentially painful teaching procedures after instructor and department have concluded that teaching such procedures is essential to a complete educational experience.
Descriptors: animal welfare, teaching, pain, stress, castration, branding, dehorning, ear notching, teeth clipping, beak trimming, comb and wattle removal, tail docking.

McGlone, J.J. (1993). **What is animal welfare?** *Journal of Agricultural & Environmental Ethics* 6 (special suppl.2): 26-36.
NAL call number: BJ52.5.J68
Descriptors: animal welfare, animal production, stress, animal behavior, animal physiology, pain, depression, immunological deficiency, animal health, animal husbandry.

Mench, J.A. (1993). **Assessing animal welfare: an overview.** *Journal of Agricultural & Environmental Ethics* 6 (special suppl.2): 68-75.
NAL call number: BJ52.5.J68
Descriptors: animal welfare, livestock, animal behavior, emotions, motivation, mental ability, animal physiology, assessment.

Moberg, G.P. (1993). **Using risk assessment to define domestic animal welfare.** *Journal of Agricultural & Environmental Ethics* 6 (special suppl.2): 1-7.
NAL call number: BJ52.5.J68
Descriptors: farm animals, animal welfare, animal husbandry, stress factors, risk, guidelines.

Moore, R.P. (1998). **Perception and reality-welfare in farm animals.** In *Ethics, welfare, law and market forces: the veterinary interface. Proceedings of a Symposium, Royal College of Veterinary Surgeons, UK, 14-15th November 1996,* A.R. Michell and R. Ewbank, (eds.), Wheathampstead, UK: Universities Federation for Animal Welfare (UFAW), p. 67-70.
NAL call number: HV4704.E84 1998
Descriptors: animal welfare, livestock.

Otto, K.A. and C.E. Short (1998). **Pharmaceutical control of pain in large animals.** *Applied Animal Behaviour Science* 59(1-3): 157-169.
NAL call number: QL750.A6
Descriptors: pain management, analgesia, livestock, animal husbandry, livestock, animal welfare, drugs, review.

Rushen, J. and A.M.B. De Passille(1992). **The scientific assessment of the impact of housing on animal welfare: a critical review.** *Canadian Journal of Animal Science* 72 (4): 721-743.
NAL call number: 41.8 C163
Descriptors: livestock, animal welfare, animal production, animal housing, animal husbandry, abnormal behavior, stress.

Sandoe, P., N. Holtug, H.B. Simonsen (1996). **Ethical limits to domestication.** *Journal of Agricultural & Environmental Ethics* 9 (2): 114-122.
NAL call number: BJ52.5.J68
Descriptors: livestock, domestication, animal welfare, genetic engineering, selective breeding, transgenics, genetic

change, regulations, European Union.

Stricklin, W.R. and J.A. Mench (1994). **Oversight of the use of agricultural animals in university teaching and research.** *ILAR News* 36(1): 1-6.
NAL call number: QL55.A1I43
Descriptors: land grant universities, impact of agricultural research, monitoring agricultural animal care and use, commercial production practices, standards for evaluating animal research and teaching, administration of IACUCs, protocol review and facility inspection, agricultural animal technicians and standards of care.

Stricklin, W.R. and J.A. Mench (1993). **An international conference on farm animal welfare: ethical, scientific and technological perspectives.** *Journal of Agricultural & Environmental Ethics* 6 (special suppl.1): 1-3.
NAL call number: BJ52.5.J68
Descriptors: livestock, animal production, animal welfare, conferences.

Stricklin, W.R. (1989). **The development of guidelines for the care and use of agricultural animals used in agricultural research and teaching.** In *Animal Care and Use in Behavioral Research: Regulations, Issues, and Applications* J.W. Driscoll (ed.), Beltsville, Maryland: United States Department of Agriculture/National Agricultural Library, pp. 44-51.
NAL call number: aHV4762.A3A64
Descriptors: agricultural animal care and use program, institutional policies.

Swanson, J.C. (1998). **Oversight of farm animals in research.** *Lab animal* 27(3): 28-31.
NAL call number: QL55.A1L33
Descriptors: livestock, regulations, hazards, animal welfare.

Tauson, R. (1993). **Research approaches for improving the physical welfare and environment of laying hens.** *Journal of Agricultural & Environmental Ethics* 6 (special suppl.2): 76-85.
NAL call number: BJ52.5.J68
Descriptors: hens, intensive livestock farming, animal welfare, battery cages, design, animal health, animal husbandry, egg production, abnormal behavior, cannibalism, stocking density.

Tillman, P. (1994). **Integrating agricultural and biomedical research policies: conflicts and opportunities.** *ILAR News* 36 (2): 29-35.
NAL call number: QL55.A1I43
Descriptors: livestock, agricultural research, medical research, committees, guidelines, regulations, animal welfare.

Wiepkema, P.R., W.G.P. Schouten, and P. Koene (1993). **Biological aspects of animal welfare: new perspectives.** *Journal of Agricultural & Environmental Ethics* 6 (special suppl.2): 93-103.
NAL call number: BJ52.5.J68
Descriptors: livestock, animal welfare, stress, emotions, social interaction.

Useful World Wide Web Sites

Farm Animal Council of Saskatchewan
http://www.facs.sk.ca/
A comprehensive site that includes codes of practice for all farm animals.

National Institute for Animal Agriculture
http://animalagriculture.org/
The National Institute for Animal Agriculture (NIAA), successor to the Livestock Conservation Institute (LCI), began

operation in January 2000 and is collectively addressing issues of interest to the industry, providing vital industry information, continuing education and communication outlets for animal agriculture professionals.

New Zealand Ministry of Agriculture and Fisheries
http://www.maf.govt.nz/biosecurity-animal-welfare.aspx
Codes of recommendations and minimum standards for all farm animals and farm-reared deer.

Pain
http://www.iacuc.arizona.edu/handbook/pain.shtml
Species specific signs of pain in farm animals and other laboratory animals.

Q FEVER
http://www.iacuc.arizona.edu/training/cattle/occup.html#qfever
Coxiella burnetii, a rickettsial organism that is highly resistant to physical and chemical agents used in disinfection. It has been reported in most warm blooded animals including fowl. The most common source of infection in the United States is from sheep, although goats and cattle can carry the disease. This site is provided by the University of Arizona.

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Wildlife and Field Research

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- Safe, Effective and Humane Techniques for Euthanizing Wildlife in the Field
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Safe, Effective and Humane Techniques for Euthanizing Wildlife in the Field

Michael Aprill

Michael Aprill is a recent graduate of the University of Wisconsin--Stevens Point with a degree in biology. During 1994, he served as a Volunteer in the Parks (VIP) for the Division of Resource Management at Hawaii Volcanoes National Park. Originally published in *Park Science,* Volume 18(1), July 1998.

Resource managers across the national park system are occasionally faced with the need to destroy wildlife species for a number of reasons, such as protection of endangered species, protection of the public health, and population control of species.

When choosing euthanasia techniques as part of a resource management program, managers must select techniques that are humane for the species being euthanized, safe for personnel carrying out the procedure, not dangerous to park visitors or nontarget species, and appropriate for the location and feasible within personnel and budgetary constraints.

In selecting a euthanasia technique, the manager must first consider that the technique is efficient and humane for the target species (American Society of Mammalogists 1987). The universally accepted standards for these criteria are found in the ô1993 Report of the American Veterinary Medicine Association (AVMA) Panel on Euthanasia (American Veterinary Medical

Euthanasia by the injection of barbiturates (e.g., sodium pentobarbital) is perhaps the most humane euthanasia technique, and it is suitable for most species, safe for personnel performing the procedure, and moderate in cost (Fakkema 1994; Grier and Clovin 1990; American Humane Association 1988). Barbiturates are one of the cheaper euthanasia agents. However, as a controlled substance, the use of barbiturates requires a permit from the Drug Enforcement Administration, secure storage, and veterinarian supervision. The animal must be restrained during administration (e.g., squeeze cage) and personnel performing the procedure must be skilled. Dosages must be correct for the species and the animals weight. A parks maintenance staff may construct squeeze cages of their own design or by using designs found in the literature. If a veterinarian is not on staff, one may be available from a nearby humane

society or a local vet may be willing to consult as a nonpaid volunteer.

Another effective, humane, safe, and inexpensive euthanizing technique is carbon dioxide (Erickson 1994). This technique works well for most animals; however, some species and neonates may have some increased tolerance to carbon dioxide. Because carbon dioxide is heavier than air, care must be taken to completely fill the chamber before exposing the animal to the gas. This is of special concern with tall or climbing animals. Carbon dioxide is low cost. Supplies include a carbon dioxide canister, carbon dioxide, appropriate plumbing, and a chamber that can be constructed by park personnel. The main disadvantage of this technique is that it may not be suitable for remote or inaccessible locations due to difficulties transporting heavy carbon dioxide canisters.

If done properly by trained personnel, gunshot may be used as a humane form of euthanasia. For each species, the shot must be fired at a specific site on the animal to assure rapid death (Australian Veterinary Association 1987; Longair et al. 1991). One danger of this technique is that a bullet may ricochet off the substrate or cage and injure the shooter or others. The shooter must also have adequate eye and hand protection due to the possible danger from blood-borne pathogens. Additionally, there may be legal reasons why a manager may not want to use firearms in a park.

Managers wishing to learn more about specific euthanasia techniques are encouraged to consult the resources cited in this article or attend a euthanasia seminar sponsored by an organization such as the American Humane Association. For a summary of humane euthanasia techniques see table 1.

Table 1--Humane euthanasia techniques*

Method	Advantages & Disadvantages	Cost
Injection Barbiturates	Most preferred method of euthanasia Suitable for most species. Safe for personnel performing procedure. Requires DEA permit, secure storage, and veterinary supervision. Requires squeeze cage, which may be easily constructed by park personnel.	Moderate
Carbon Dioxide CO_2	Works well for most species. Some species and neonates may exhibit increased tolerance to CO_2. Special care must be taken with tall or climbing animals to completely fill the chamber before exposing the animal. CO_2 chamber may be easily constructed by park personnel. Safe for personnel performing the procedure. May not be suitable for remote locations due to weight of CO_2 canisters.	Low
Gunshot	Firearm must be of appropriate caliber and impact for species and must be delivered to specific site on animal. Requires skilled marksman. Possible danger to shooter from ricochet. Possible legal constraints in some parks.	Moderate
*All methods can be humane and safe if administered by properly trained personnel		

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Choate, J. R., editor. 1987. Acceptable field methods in mammalogy: Preliminary guidelines approved by the American Society of Mammalogists. Journal of Mammalogy 3(2) (Suppl.):1-18.

Erickson, R. 1994. Carbon dioxide euthanasia chamber. Wildlife Control Technology (December):12-13.

Fakkema, D. 1994. Euthanasia 101:94AHA-46-47. Two audio cassettes. American Humane Association. Hollywood, California.

Greyhavens, T. 1989. Handbook of pentobarbital euthanasia. Humane Society of the Willamette Valley, Salem, Oregon. 126 p.

Grier R. L., and T. L. Clovin. 1990. Euthanasia guide (for animal shelters). Moss Creek Publications, Ames, Iowa.

Longair, J. A, G. G. Finley, M. A. Laniel, C. Mackay, K. Mould, E. D. Olfert, H. Rowsell, and A. Preston. 1991. Guidelines for euthanasia of domestic animals by firearms. Canadian Veterinary Journal 32(12): 724-726.

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NAL call number: SF406.W55 1995
Descriptors: wild animals, mammals, wild birds, marking, capture of animals, trapping, wildlife management, animal experiments, bioethics, animal welfare.

Bielitzki, J.T. (1996). **The Institutional Animal Care and Use Committee within the zoological park: selecting and training members.** In *The well-being of animals in zoo and aquarium sponsored research,* G.M. Burghardt, J.T. Bielitzki, J.R. Boyce and D.O. Schaeffer (eds.), Greenbelt, Maryland: Scientists Center for Animal Welfare, p. 107-110.
NAL call number: QL77.5.W45 1996
Descriptors: animal welfare, zoological research, wild animals in captivity, training new members.

Bowman, P. (1989). **Institutional animal care and use committee: Review of wildlife field research.** *Lab Animal* 18(3): 28-30.
NAL call number: QL55.A1L33
Descriptors: wildlife management, wild animals, animal research, research institutes, animal welfare, surveys.

Cooper, J.E.(1998). **Minimally invasive health monitoring of wildlife.** *Animal Welfare* 7(1): 35-44.
NAL call number: HV4701.A557

Descriptors: wild animals, animal health, monitoring, animal welfare, techniques, alternatives.

Elliott, C.L. (1995). **Meeting animal care obligations in wildlife education.** *Wildlife Society Bulletin* 23(4): 631-634.
NAL call number: SK357.A1W5
Descriptors: education, research, surveys, wildlife, training, prevention, institutions, animal welfare, wild-animals.

Kohn, B. (1996). **IACUCs: how do they relate to zoos and aquariums?** In *The well-being of animals in zoo and aquarium sponsored research*, G.M. Burghardt, J.T. Bielitzki, J.R. Boyce and D.O. Schaeffer (eds.), Greenbelt, Maryland: Scientists Center for Animal Welfare, p. 103-106.
NAL call number: QL77.5.W45 1996
Descriptors: animal welfare, aquaria, zoological gardens, regulations.

Kohn, B. and S.L. Montfort (1997). **Research at zoos and aquariums: Regulations and reality.** *Journal of Zoo and Wildlife Medicine* 28(3): 241-250.
Descriptors: Exhibit animals, zoos, aquariums, research, regulations.

Kreger, M.D. (1995). **Management of wild mammals in the laboratory: other species.** In *Wildlife mammals as research models in the laboratory and field: proceedings of a seminar sponsored by the Scientists Center for Animal Welfare held in San Francisco, California at the American Veterinary Medical Association meeting on July 12, 1994*, Greenbelt, MD: Scientists Center for Animal Welfare, pp. 11-22.
NAL call number: SF406.W55 1995
Descriptors: wild animals, laboratory animals, mammals, disease models, animal models, animal husbandry, regulations, resource materials, animal welfare.

Michener, G.R. (1989). **Ethical issues in the use of wild animals in behavioral and ecological studies.** In *Animal Care and Use in Behavioral Research: Regulations, Issues, and Applications* J.W. Driscoll (ed.), Beltsville, Maryland: United States Department of Agriculture/National Agricultural Library, pp. 37-43.
NAL call number: AHV4762.A3A64
Descriptors: field studies, animal care committees, maintaining wild species, guidelines.

Olsen, G.H. (1989). **The Animal Welfare Act and the zoo: A positive approach.** *Journal of Zoo and Wildlife Medicine* 20(2): 135-137.
NAL call number: SF601.J6
Descriptors: zoo animals, legislation, regulations.

Orlans, F.B. (1988). ***Field Research Guidelines: Impact on Animal Care and Use Committees,*** Scientists Center for Animal Welfare, Bethesda, MD, 23 p.
NAL call number: HV4704.F5
Descriptors: treatment of animals, wildlife, standards.

Peck, F.R. and R.C. Simmonds (1995). **Understanding animal research regulations: obligations of wildlife departments and field researchers.** *Wildlife Society Bulletin* 23(2): 279-282.
NAL call number: SK357.A1W5
Descriptors: wildlife, animal experiments, animal welfare, regulations.

Putman, R.J. (1995). **Ethical considerations and animal welfare in ecological field studies.** *Biodiversity and Conservation* 4(8): 903-915.
NAL call number: QH75.A1B562
Descriptors: wild animals, wildlife, animal welfare, capture of animals, trapping, marking, stress, mortality, research, ecology, field experimentation, ethics.

Shoemaker, A.H., K.L. Vehrs, R. Howarth, and W. Fontana (1994). ***AZA (American Zoo and Aquarium Association) Manual of Federal Wildlife Regulations,*** Bethesda, Maryland: American Zoo and Aquarium Association, 2 volumes: v. 1. Protected species; v. 2. Laws and regulations.
NAL call number: KF5640.A4A9 1994

Descriptors: wildlife conservation, animal welfare, endangered species, wild animal trade.

Waples, K.A. and C.S. Stagoll (1997). **Ethical issues in the release of animals from captivity.** *BioScience* 47(2): 115-120.
NAL call number: 500 Am322A
Descriptors: wild animals, release, animal welfare, ethics.

Useful World Wide Web Sites

American Society of Mammalogists, Animal Care and Use Committee
http://www.mammalsociety.org/committees/
The sustaining goals of the Animal Care and Use Committee are to serve as a liaison to society members on matters concerning the care and use of wild mammals, to assist in the interpretation of new or revised governmental regulations, and to provide government and non-government agencies with reasoned, professional advice on matters of animal care and use of wild mammals.

Arizona State University, Handling Hantavirus
http://researchintegrity.asu.edu/iacuc/specialtopics/hantavirus.htm
Guidelines for wildlife researchers.

New South Wales Agriculture, Animal welfare guidelines
http://www.agric.nsw.gov.au/reader/2754
This site is provided by the government of New South Wales, Australia. Topics include: draft guidelines for the use of pitfall traps; guidelines for animal care and ethics committees (ACECs) supervising research on captive wildlife; guidelines for collection of voucher specimens; guidelines for opportunistic research on free living wildlife; individuals and institutions engaged in collaborative research.

University of Florida, Animal Care and Use
http://iacuc.ufl.edu
This site provides access to rules and regulations that govern wildlife research at the University of Florida.

Last updated July 26, 2001

Statistics and Animal Numbers

- Reducing Animal Numbers: Sequential Sampling
  (links to the article previously published in the Animal Welfare Information Center Newsletter)
- Bibliography
- Useful World Wide Web Sites

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Baker, D.G. (1998). **Natural pathogens of laboratory mice, rats, and rabbits and their effects on research.** *Clinical Microbiology Review* 11(2): 231-266.
NAL call number: QR67.C54
Abstract: Laboratory mice, rats, and rabbits may harbor a variety of viral, bacterial, parasitic, and fungal agents. Frequently, these organisms cause no overt signs of disease. However, many of the natural pathogens of these laboratory animals may alter host physiology, rendering the host unsuitable for many experimental uses. While the number and prevalence of these pathogens have declined considerably, many still turn up in laboratory animals and represent unwanted variables in research. Investigators using mice, rats, and rabbits in biomedical experimentation should be aware of the profound effects that many of these agents can have on research.
Descriptors: bacterial infections, parasitic diseases, rodent diseases, virus diseases, microbiology, mice, rabbits, rats, reproducibility of results, epidemiology, immunology, parasitology, virology.

Crouse, D.A., Mann, M.D., and E.D. Prentice (1995). **The logical determination of "n" in animal experimentation.** In *"Current Issues and New Frontiers in Animal Research*, K.A.L. Bayne, M. Greene, and E.D. Prentice, eds., Greenbelt, Maryland: Scientists Center for Animal Welfare, pp. 19-23.
NAL call number: HV4913.C87 1995
Descriptors: review of basic elements that significantly impact animal use, review of statistical parameters which should be considered in the design of a typical research protocol, review by IACUC, Type I vs Type II error, level of significance.

Erb, H. (1996). **A non-statistical approach for calculating the optimum number of animals needed in research.** *Lab Animal* 25(3): 45-49.
NAL call number: QL55.A1L33
Descriptors: elements of sample size calculation, assessment of the kind of data, descriptive vs. comparative analysis, common sample size mistakes, methods to decrease sample size.

Festing, M.F.W. (1995). **Variation and experimental design.** *Scientist Center for Animal Welfare Newsletter* 18(3): 3-9.
NAL call number: QL55.N48
Descriptors: minimizing animal numbers, variability, laboratory animals, quality control, statistical analysis, experimental design, understanding variation in experimental results.

Festing, M.F.W. (1994). **Reduction of animal use-experimental design and quality of experiments.** *Laboratory*

Animals 28(3): 212-221.
NAL call number: QL55.A1L31
Descriptors: variability, animal numbers, statistical analysis, understanding statistics.

Festing, M.F.W. (1992). **The scope for improving the design of laboratory animal experiments.** *Laboratory Animals* 26(4): 256-267.
NAL call number: QL55.A1L31
Descriptors: principles of experimental design, no built in bias, precision, variability, control of variability, ability to detect differences, practical considerations versus theoretical statistical considerations, simplicity, experimental error, completely randomized single-factor design, randomized block design, increase in efficiency from randomized block designs, factorial arrangement of treatments, review.

Geller, N.L. (1983). **Statistical strategies for animal conservation.** *Annals of the New York Academy of Sciences* 406:20-29.
NAL call number: 500 N484
Descriptors: randomization, confounding factors, sample size and power, analysis, group sequential designs, historical controls, serial sacrifice, carcinogenesis, bioassays, teratogenesis, experimental design, animal numbers, alternatives.

Khamis, H.J. (1997). **Statistics and the issue of animal numbers in research.** *Contemporary Topic in Laboratory Animal Science* 36(2): 54-59.
NAL call number: SF405.A23
Descriptors: unified approach to determining animal numbers, methods to determine and justify animal numbers, 3-step approach, pilot study or inferential study, determining minimum numbers necessary to achieve research goals, justifying animal numbers, experimental design, 3R's, examples.

Mann, M.D., Crouse, D.A., and Prentice, E.D. (1991). **Appropriate animal numbers in biomedical research in light of animal welfare considerations.** *Laboratory Animal Science* 41(1): 6-14.
NAL call number: 410.9 P94
Descriptors: statistics, sample size, variability, nonstatistical factors, ethics, economics, effect size, experimental design.

McCance, I. (1995). **Assessment of statistical procedures used in papers in the Australian Veterinary Journal.** *Australian Veterinary Journal* 72(9): 322-328.
NAL call number: 41.8 AU72
Abstract: One hundred and thirty-three papers (80 Original Articles and 53 Short Contributions) of 279 papers in 23 consecutive issues of the Australian Veterinary Journal were examined for their statistical content. Only 38 (29%) would have been acceptable to a statistical referee without revision, revision would have been indicated in 88 (66%), and the remaining 7 (5%) had major flaws. Weaknesses in design were found in 40 (30%), chiefly in respect to randomisation and to the size of the experiment. Deficiencies in analysis in 60 (45%) were in methods, application and calculation, and in the failure to use appropriate methods for multiple comparisons and repeated measures. Problems were detected in presentation in 44 (33%) of papers, with insufficient information about the data or its statistical analysis and presentation of statistics (appropriate missing or inappropriate shown) the main problems. Conclusions were considered to be inconsistent with the analysis in 35 (26%) of papers, due mainly to their interpretation of the results of significance testing. It is suggested that statistical refereeing, the publication of statistical guidelines for authors and statistical advice to Animal Experimentation Ethics Committees could all play a part in achieving improvement.
Descriptors: analysis of variance, standards, random allocation, research design , statistics reproducibility of results.

Morton, D.B. (1998). **The importance of nonstatistical design in refining experiments.** *ANZCCART News* 11(2-insert):1-11. Available at http://www.adelaide.edu.au/ANZCCART/publications/ImportanceNonStat_T5Arch.pdf
NAL call number: SF405.5.A3
Descriptors: alternatives, refinement, use of anesthetics and analgesics, importance of skilled and competent investigators, statistical advice, limitations of scientific evidence, extrapolation and animal numbers, pilot studies, dose sighting and control groups, adverse effects causing pain and distress, humane endpoints, score sheets, recognition and

assessment of pain and distress.

Orlans, F.B. (1986). **Ideas for experimental design of experiments involving animals.** *Laboratory Animal Science* 36(5): 557.
NAL call number: 410.9 P94
Descriptors: design of experiments, procedures, review process.

Ruxton, G.D. (1998). **Experimental design: minimizing suffering may not always mean minimizing number of subjects.** *Animal Behaviour* 56(2): 511-512.
NAL call number: 410 B77
Descriptors: experimental design, laboratory animals, animal numbers, animal welfare.

Straughan, D.W. (1995). **The EU target for a 50% reduction in use of experimental animals by the year 2000--what does it mean?** *Alternatives to Laboratory Animals: ATLA* 23(2): 262-263.
NAL call number: Z7994.L3A5
Descriptors: animal experiments, animal testing alternatives, animal welfare, European Union regulations.

Weigler, B.J. (1995). **Justifying the number of animals in IACUC proposals.** *Contemporary Topics in Laboratory Animal Science* 34 (3):47-50.
NAL call number: SF405.5.A23
Descriptors: laboratory animals, usage, committees, regulations, bioethics, experimental design, statistics, reviews.

Whary, M.T., D.D. Carey, and F.G. Ferguson (1998). **Reduction in animal numbers required for antisera production using the subcutaneous chamber technique in rabbits.** *Laboratory animals* 32(1): 46-54.
NAL call number: QL55.A1L3
Abstract: The purpose of this study was to determine if the subcutaneous chamber technique would reduce the number of rabbits required for antisera production by enabling serial use of individual animals for multiple antigens. Rabbits were assigned to immunization protocols against two antigens in series that involved combinations of chamber implantation, Freund's adjuvant and injection of antigen either by the subcutaneous route or by direct inoculation into the chamber. Results indicate the systemic immune response to both antigens achieved similar magnitude and duration by use of either Freund's adjuvant or direct inoculation of antigen into the chamber, suggesting that chamber use may be able to replace use of Complet e Freund's adjuvant for many antigens. Rabbits re-used for a second antigen were equally successful in production of significant titres in both serum and chamber fluid without evidence of either a significant inflammatory response due to the chronic presence of the implant or a decrease in the yield of antisera harvested from the chamber. These results support the advantages of chamber use as reported by others and demonstrate that the chamber technique can significantly extend the productive life of an individual animal that would otherwise be euthanized following a single use in antisera production.
Descriptors: rabbits, immune serum, biological production, antigens, antibody formation, yields, hemocyanins, adjuvants, cholera, bacterial toxins, containers, implantation, animal welfare, alternatives.

Useful World Wide Web Sites

Guidelines for Determination and Justification of Animal Numbers
http://www.research.uci.edu/ora/acup/animalnumbers.htm
Topics included in this site provided by the University of California at Irvine are: overview, basis, study design, pilot studies, inclusiveness, alternative methods, inbred animals, repetition of experiments, modification of approved animal number, and references.

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Disaster Planning

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Disaster Planning for Animal Facilities

The U.S. Department of Agriculture gratefully acknowledges the Florida Animal Disaster Planning Advisory Committee (ADPAC) for permission to use the following article and checklist. Their website is http://www.fl-adpac.org/

ADPAC is an ad hoc group of organizations and individuals interested in promoting the effective development and implementation of disaster plans to protect animals. The group was organized after Hurricane Andrew killed, injured, and displaced tens of thousands of dogs, cats, horses, cattle, birds, exotic pets, and other animals.

ADPAC is not a formal legal entity. Its members seek to open lines of communication among the various animal groups in the state, and with governmental entities that develop and implement disaster plans with the goal of protecting human lives and property. It is the belief of ADPAC that the plans for humans and animals must be intertwined if either are to be effective.

If you would like information on ADPAC, contact Laura Bevan, Southeast Regional Office Director, The Humane Society of the United States, 1624 Metropolitan Circle, Suite B, Tallahassee, FL 32308, call (850) 386-3435, or e-mail lbevan@unr.net for more information.

Introduction:

It is vital that animal facilities prepare for disasters, not only for the animals housed inside, but so that the facility will be viable in the aftermath. These facilities will include animal shelters, kennels, veterinary clinics and hospitals, pet shops, horse stables and other facilities where animals are routinely housed. The following guidelines are appropriate for all and will help determine which disasters and dangers a facility may be vulnerable to, and what plans they can make now to mitigate damage and downtime.

Evaluate your Animal Facility

A. Know the dangers of the facility's location. Are you:

- in a storm surge area for hurricanes of any category?
- in a flood plain for nearby lakes, creeks or rivers?

- located near any hazardous waste plants or disposal sites?
- near any railroad tracks with trains carrying hazardous wastes?
- near any interstates that have trucks carrying hazardous wastes?
- near any fuel depots?
- in an area prone to wildfire?
- near any area with earthquake faults?
- in an area that a power outage could create a heat or cold emergency?
- Fire: we all run the risk - our most common and deadliest single disaster. Check with your local emergency management department or fire department for assistance in assessing the potential disasters in your area.

B. Know the dangers of the actual structure:

- What is the building made of (wood, concrete, brick, etc.). Is it solid enough to withstand hurricane force winds?
- Does it have sliding glass doors, large windows or a large number of windows? Do these have hurricane shutters or appropriate coverings for heat or cold emergencies?
- If the facility has kennels, are they indoor/outdoor runs or all indoor?
- What areas of the facility would be safe in a hurricane or tornado? Are there interior areas that would be protected?
- Is the roof secure? Is it hurricane clipped or strapped? Is it capable of water loading from heavy rains, snow or ice?
- Do you have exposed, overloaded, or old electrical wiring that could start a fire?
- Does the facility have a number of fire extinguishers, and are they in convenient and easy to locate?
- Do you have smoke detectors throughout the facility, and are the batteries checked at least twice a year? (An alert system and sprinklers are preferred.)
- Do you allow smoking in or around the building? If so, is a proper smoking policy in effect?
- Is the area around the facility cleared of underbrush and trees to prevent wildfire from spreading to the building?

It would be advisable to have the building properly evaluated by an engineer or another professional experienced with the requirements necessary for a facility to withstand a major disaster. Check with your emergency management department to see if this is a service it provides or if it can recommend a professional.

Insurance

Is your insurance adequate to cover all losses? You need to properly evaluate your coverage at least once a year.

A. Identify your facility on the flood plain and or storm surge map located at your local Emergency Management Department.

B. Make a complete inventory of the property, including photographs of each room. Store this written or videotaped inventory with insurance papers in a safe place, keeping a duplicate inventory file off-premises.

Set Priorities

A. Identify the most expensive or irreplaceable items (the animals in the facility will be your top priority) and create plans to preserve and protect them.

B. Identify what items are most necessary to get the facility operating again. (i.e. records, equipment, etc.)

C. Movable Inventory (i.e. animal control trucks, cars, etc.) - make arrangements now for a safe location where these items can be moved well in advance of the storm. Make sure your vehicles are not moved to a location where they can be immobilized, such as by falling trees, flying debris, or flood waters. Tie them down if appropriate.

D. Move important inside equipment to the center of the room as high as possible (upstairs if available) and wrap it with waterproof tarps or plastic. Secure with a rope or tape. Anchor downstairs furniture.

E. If you are in a floodplain, make arrangements to move as much as possible from this location well in advance.

F. Glass - Shutter or board all glass to prevent it from flying around doing additional damage or injury. Whenever possible, large windows or sliding glass doors should be covered with commercial hurricane shutters, since it is difficult for them to be properly boarded. In case of wildfire, remove drapes when one threatens to prevent them from catching fire as the glass becomes heated.

G. Contact your local fire service and ask them to do a fire drill at your facility so they are familiar with where the animals are housed. Also ask them to do a walk through to point out situations which might be fire or chemical hazardous.

H. Install a fire alarm system, if you do not already have one. Have it connected directly into the fire department. By the time an internal alarm is heard, it could be too late.

I. Have fire extinguishers readily available throughout the facility and make sure all employees know how to operate one.

J. Install a lightning suppression system.

K. If in a wildfire prone area, keep hoses attached on all sides of the building with lawn sprinklers for wetting down roofs.

Create a Pyramid of Employee Release

A. Release all non-essential personnel as soon as possible so they can assist their families in making preparations. See that all employees have written personal disaster plans covering their home, family and pets - if they are prepared, they are better able to concentrate on assisting in getting the facility prepared effectively.

B. Release second level of employees as soon as they have completed their assigned disaster preparation duties.

C. Remaining employees leave as soon as premises are prepared and secured. Always start well in advance - the key to minimize damage and injury is evacuate as quickly as possible. All employees should be released in time for them to reach safe shelter. In the case of hurricanes, this should be before sustained winds reach 45 mph.

D. Explain:

- Watch: generally issued 72 hours prior to an expected event - preparations should begin at that time. The radio should be monitored constantly.

- Warning: generally issued when the expected event is imminent within the next 24 hours or sooner. Depending on when the Warning is issued (day, night, weekend) your plan may change dramatically. Depending on your operating hours you may have to plan to call in key employees to prepare the

facility. Home phone numbers should be kept with the manager or director at all times. Also call non- essential employees and tell them not to report to work until further notice. Have a plan to recontact employees if telephone lines are inoperable.

E. It is not recommended that you demand participation of employees in responding to the aftermath of a disaster. Your disaster plan could fall apart if you depend on certain people who are not available because of family concerns.

F. Recognize in developing the personnel section of your disaster plan that even those employees who make a commitment to assist before or after a disaster may not be able, for reasons beyond their control. Cross train employees in disaster duties.

Specific Preparations

A. Hazardous Materials

- Make sure all hazardous materials are labeled - if they do get washed away or strewn about your local clean-up crews will know what they are dealing with.
- Attach all outside storage cylinders to the building (attach at top and bottom); if attached at only one place, cylinders can be battered against the building and possibly break valves. Remember, nothing is too heavy to worry about!
- If small quantities of hazardous materials are stored on open shelves, make sure the shelves have adequate lips to keep materials on the shelves. Make sure cupboards are fitted with positive latches.
- Separate all incompatible chemicals!
- Keep up-dated inventories of all hazardous materials - store this in a safe place off premises or take it with you upon evacuation.
- Shut down the valves on all tanks before leaving.

B. Records

- If possible, put vital records on hard disk to be taken along when leaving, or electronically transfer all important records to a location outside the expected disaster area.
- If records are not computer compatible, place them inside plastic bags and then pack in boxes.
- Seal the boxes with tape.
- Mark the outside of the box with pertinent information, such as department name and/or name of supervisor responsible for records.
- If records are confidential, indicate this on the outside of the box.
- Take boxes to a central location to receive an assigned number and to be inventoried.
- Remove boxes to a safer location outside of the disaster area - this location should be pre-determined.

C. Assign employees to clear outside area of all loose objects. Remove flags from poles as this substantially increases the ability of the flagpole to withstand wind.

D. If the shelter has any refrigerated inventory (drugs, medicines, etc.) immediately set all refrigerators to

the lowest setting. However be aware that once the power is off refrigerated items generally will stay cold for approximately 48 hours. If the power outage is expected to be longer than this, or if the items will otherwise be lost, relocate them or donate them to relief efforts.

E. Drive any motor vehicles to a safe location, if there is none at the facility. Make sure the vehicles are fully fueled, since gas stations will be unable to operate due to lack of power.

F. Empty freezer of any dead carcasses and dispose of properly. Turn freezer on as cold as possible for holding of dead animal bodies immediately after the disaster.

Final Securing of Premises

A. Contact your alarm system company and local officials advising that you are shutting down operation of the facility.

B. Provide employees' with appropriate identification showing employment or relationship to the animal facility so that they will be able to return after the storm.

C. Unplug all equipment and turn off electricity at breakers before leaving - including air conditioning, water heaters, gas and water (this helps prevent contamination).

D. Recheck valves on hazardous materials tanks to make sure they are fully closed.

Returning after the Disaster

A. Avoid all metal as it may be energized. Wear rubber boots and rubber gloves.

B. Enter with extreme caution; check structural integrity. Always use a buddy system when entering the structure.

C. Don't strike matches, as gas leaks or leaks of other hazardous materials are common. Use flashlights only.

D. Make a written assessment of the building and its contents. Photograph as similarly to the original inventory photographs as possible, to expedite insurance processing.

E. Make any safety repairs immediately that are necessary to protect employees and minimize further damage.

F. If there has been flooding or rain damage, have an electrician inspect the premises before turning on the breakers.

G. DON'T connect emergency generators to the building wiring as unsuspecting repair crews may be injured or killed. Operate any necessary equipment directly off the generator. Use generators outside only as they expel carbon monoxide.

H. Continue to use communication systems only for emergencies.

I. Remember that water will be contaminated, creating a health hazard.

J. Employees should be instructed not to attempt to return to work until notified.

K. Notify outside agencies, such as national or state humane and animal control organizations, of your

status. If you need assistance of any kind, the faster you call, the faster it will arrive. It is generally much easier for you to call out of a disaster area than it is for others to call into one.

On-Going Planning

A. Flood-Plain Map - Keep one posted at all times in employee and public lounges or waiting areas.

B. Provide regular training for all employees in CPR, First Aid (for humans and animals) and disaster preparations, particularly in tornado, earthquake, and fire response (use of fire extinguishers and their locations in the facility.

C. Hold quarterly fire, tornado, and earthquake drills.

D. Review and update your disaster plan annually.

E. Supplies needed at all times:

- Flashlights with batteries (refrigerated for longer life).
- Transistor Radio with batteries
- Fire Extinguisher
- Tarps and/or plastic
- Rope or cord
- Tape
- Tools necessary to shut down equipment, tanks, etc.
- First Aid Kits for human and animals
- Food and water to last for 1 -2 weeks
- Portable corrals for livestock
- Collapsible cages or crates
- Additional collars, leads, leashes, halters
- Additional office supplies of those items used frequently
- Weather Alert Radio
- Police Scanner

F. Make sure personnel are up-to-date on protective shots such as rabies, tetanus, hepatitis, etc.

G. Develop a telephone tree of employees and, possibly, volunteers to notify them of disasters or pending disasters. Make provisions, however, for communication in case telephone lines are down. Pre-arrange meeting sites with needs list in case communication is impossible.

H. Obtain, or get a commitment for, a generator with the capacity to operate basic functions of the facility. If you have obtained a generator for permanent use, have the hook-up to your electric pre-wired by a qualified electrician. Make sure staff know how to properly operate after a disaster.

I. Keep a list of telephone numbers of local, state and national groups that could provide assistance.

J. Develop a communications system with flexibility. Do not depend on one form of communication after a disaster.

- Telephone tree - those whose telephones are working and who can relay information around and out of the disaster area.
- Make contacts with local ham radio operators. See if someone can relay messages for the facility after a disaster.
- Become part of your emergency management department's system.
- Portable CB's will work short distances if all other systems are down. Information can be relayed by

CB until better systems are operating.

- Cellular phones may not work because of downed relaying towers or crowded airwaves, but are useful to have on hand.

K. Check electrical wiring regularly.

You must also plan for incidents such as tornadoes, earthquakes, or hazardous material releases for which you will have little or no advance warning.

1. Someone should be designated to make the decision on whether to evacuate or stay in the building.

2. If the decision is to remain in the building, safe areas should be identified in advance and employees should be regularly instructed as to the location of the safe areas.

You should also consider the impact of a disaster not just on your facility, but on the neighboring community or region. A disaster in your area may bring a flood of animals to your doorstep, creating a ripple disaster in your shelter.

Developed by Laura Bevan, The Humane Society of the United States, using information from the "Hurricane Action Guidelines for the Business Community" developed by Sarasota (FL) County Emergency Management.

Disaster Plan Quick Check List

This plan developed

for:_____

Date:_____

I. EVALUATION OF FACILITY

A. Known dangers to facility in area

_____ Storm Surge area

_____ Flood Plain

_____ Hazardous material plants or disposal sites

_____ Railroad tracks

_____ Interstates

_____ Fuel depots

_____ Wildfires

_____ Earthquake faults

_____ Fire inside facility

_____ Heat or cold emergencies

_____ Emergency Management has assessed dangers to facility

B. Dangers of structure

Construction quality of building: ____Excellent ____Good ____Fair ____Poor

Glass: ____Sliding doors ___Large windows ____Large number of windows

Kennels: ___Indoor / outdoor ___Indoor only ___Outdoor only ___Other

_____ Presence of interior "safe" areas

_____ Roof hurricane strapped or clipped

_____ Exposed, overloaded, or old electrical wiring

_____ Professional evaluation of facility

_____ Area cleared around structure

II. INSURANCE

_____ Annual check for adequacy

_____ Location identified on flood plain map

_____ Inventory done

III. PRIORITIES

_____ Identify vital property and protect

_____ Movable inventory (i.e. vehicles)

_____ Secure furniture

_____ Glass secured

_____ Fire drill conducted

_____ Fire alarm installed

_____ Fire extinguishers installed

_____ Employees trained to use extinguishers

_____ Lightning suppression system installed

_____ Adequate hoses attached to building

IV. EMPLOYEES

_____ Pyramid of release

_____ Personal disaster plans

_____ Non-business hours plan

_____ Notification of return

_____ Training in C.P.R.

_____ Training in First Aid (human & animal)

_____ Training in Disaster Planning

_____ Cross training done

_____ Up-to-date protective shots

V. SPECIFIC PREPARATIONS

_____ Hazardous Materials - Labeled, secured

_____ Outside tanks - secured and valves closed

_____ Incompatible chemicals separated

_____ Update inventories regularly

_____ Vital business records protected and secured

_____ Prepared for loss of power

_____ Outside area clear of loose objects

_____ Flags down

_____ Refrigerated inventory protected

_____ Movable inventory, fueled and protected

_____ Freezer emptied of carcasses

_____ Generators available

VI. FINAL SECURING OF PREMISES

_____ Contact alarm companies

_____ Take identification

_____ Unplug equipment, shut off breakers, gas and water

_____ Recheck hazardous material valves

VII. RETURNING AFTER THE DISASTER

_____ Rubber gloves and boots

_____ Enter with buddy

_____ Flashlights only

_____ Inventory

_____ Safety repairs

_____ Building checked by electrician

_____ Outside agencies notified of status

VIII. PLANNING

_____ Flood Plain Map posted

_____ Flashlights with batteries

_____ Transistor radio with batteries

_____ Weather alert radio

_____ Police scanner

_____ Fire Extinguishers

_____ Tarps and/or plastic

_____ Rope and tape

_____ Tools

_____ First Aid Kits (animal & human)

_____ Food/Water

_____ Extra cages and crates, halters

_____ Quarterly disaster drills - test smoke detector batteries

_____ Disaster plan updated annually

_____ Annually recharge fire extinguishers

_____ Identify safe areas from tornados, earthquakes, etc.

_____ Telephone tree created

_____ Electrical wiring checked

On _____ this plan should be re-evaluated and employees should be re-trained.

_____

_____

Signature & Date

Preparing the Farm and Farm Animals for Disasters

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Introduction

Disasters such as hurricanes, tornadoes, floods, earthquakes, severe winter weather, hazardous material spills or nuclear power plant accidents can occur any time. The event may occur suddenly or be anticipated for several days as with an approaching hurricane or flood. The time to prepare for these events is long before they occur. Even at the farm level, procedures should be written. They should be kept in a safe, fireproof, quickly accessible place with other important documents and taken along if it becomes necessary to evacuate the farm. Each member of the farm family and herd personnel should know of and practice the plan so that action may be taken even in the absence of key management personnel.

The first step in planning for a disaster is to determine what type of disaster could occur on the farm and with what frequency. It would be useless to spend time and money, for example, to plan for severe winter weather if the farm is located in a tropical environment. If the premises are near a nuclear power plant, even though the risk of an accident occurring is slim, the owners would want to consider how to protect their animals from radioactive fallout. If the farm is near a major highway, one might want to consider a hazardous material spill from a road accident in the planning. Living next to a river or stream would put planning for flooding or a barge accident in the forefront.

Only after farm owners have considered their risks can they prioritize the time, money, and other resources they wish to allocate to each potential hazard. An all-hazards plan is most desirable; however, plans should also be customized for specific situations. Once the risks are known, decisions can be made about what actions can be taken in advance and what actions would be required once the disaster occurs. Generally, the effects of a disaster on livestock are lessened by avoiding the disaster, mitigating its effect if it cannot be avoided, or sheltering the animals. The approach taken would depend upon the type of disaster anticipated. Sometimes only one approach may be appropriate such as sheltering. In some instances, combined approaches, such asmitigation and sheltering, may be required. In events such as floods or firestorms, sheltering may be the wrong thing to do.

Mitigation

Hazard mitigation is defined as any action taken to eliminate or reduce the long-term risk to life and property from natural or technological hazards. Some examples of hazard mitigation might be hurricane seeding to reduce the intensity of a storm, tying down homes or barns with ground anchors to withstand wind damage, redirecting the impact away from a vulnerable location by digging water channels or planting vegetation to absorb water, establishing setback regulations so building is not allowed close to the water's edge, and constructing levees or permanent barriers to control flooding.

The farm and farm buildings should be surveyed to figure out what mitigation procedures should be followed based on the hazard risk. These procedures include:

! building or repairing barns and outbuildings so they exceed building codes;

! constructing or moving buildings to higher ground;

! replacing or covering glass windows and doors with sturdier materials;

! keeping drainage furrows sodded;

! cleaning or moving trash piles and burial sites (Many farms contain burial sites contaminated with lead-based paints, machinery grease, motor oil, lead-lined tanks, batteries, roofing nails, asphalt, shingles, caulking compounds, linoleum and plumbing lead. During flooding this material may leech into the crops or feed supply or be moved to a more accessible area where animals could consume them.);

! moving or storing toxic chemicals, pesticides, herbicides, and rodenticides in secured areas to prevent their washing onto pastures where animals may be exposed;

! securing loose items; and

! draining or building levees around ponds that could flood.

A list of resources and people should be developed by the farmer and kept with important papers. This list should contain emergency phone numbers, suppliers, truckers, and people that can help with the animals, especially if normal working conditions are disrupted.

Supplies that may be needed during or after the disaster should be obtained. Many of these items may not be readily available after the disaster. By obtaining them in advance, more reasonable prices will be paid. Unfortunately, disasters attract individuals who gouge and prey on the misfortunes of victims. Items that could be obtained are portable radios and TV's, extra batteries, flashlights, candles, portable generators, salt, gravel, litter, fuel, antifreeze, stored feed such as hay (the amount to store would depend on the hazard--after the Washington State flood, most producers vowed never to inventory large amounts of hay due to excessive flood damage and spoilage), ropes, halters and other animal restraint equipment, and medical supplies. Onceobtained they should be stored in such a manner that they will be usable after the disaster. While in storage they should be checked at regular intervals--i.e., once a week--to assure that they do not spoil, and that electrical or mechanical appliances are still working. They should also be rechecked and evaluated after the event to assure they are still usable. A log should be kept to record when and how often the items were monitored. Animals should be kept current on all appropriate vaccinations and booster shots before the disaster. Keep a written record of the products given and the date of injection. Because the stress of the event and the disruption of the environment could cause an increase in infectious disease spread, proper vaccination could protect the animals.

Representation to Governmental Agency Managing the Disaster Response

As the disaster approaches or after it arrives, the most important thing the farmer needs is truthful, accurate, and current information. Government's response to most disasters is coordinated by a county, State, or Federal emergency management agency. Representation to this agency for the farmer is critical. In most instances, this is competently done by a member of the State or Federal Department of Agriculture. It is strongly suggested that farm organizations lobby for veterinary representation either through their State or Federal Department of Agriculture or separately to the emergency management agency. Often, the needs of animals during disasters are given low priority. Veterinarians, who are aware of these needs and can also verify the validity of requests for help, are most suited to bring animal problems to the forefront. In many instances, actions required to protect animals, such as sheltering or evacuation, must be done before a similar action is taken for people. This is because moving animals to shelter from pasture or evacuating them to other locations takes considerable time and many workers. However, governmental agencies will not issue such directives for animals before similar instructions are issued for people. They fear that a panic situation might occur and people might be critical about animals being protected before them. (Animals can always be released from the shelter or returned from their point of evacuation if the disaster does not materialize.) What they do not consider is that it must be done while it is still safe for people to do the task since animals cannot shelter or evacuate themselves. After the

disaster, government usually limits access to the disaster area. However, animals have to be fed, watered, and milked. Who is better suited to do this than the owner? Designation of farmers as emergency workers by government solves the problem of who will be responsible for this task. A veterinarian located in the emergency operating center can get these messages across.

Evacuation

If evacuation of the animals is being considered, then evacuation procedures, places, and routes should be planned. Since all animals may not be able to be evacuated, owners should decide ahead of time which are the most important ones to save. Various decision criteria can be used such as sale value, breeding quality, stage of pregnancy, stage of production, or simply sentimental preference. These animals should be identified ahead of time and a written list kept. If the owner is not home when the disaster threatens, others would then know which animals to save.

Animal evacuation routes must not interfere with human evacuation routes. Alternate routes should be found in case the planned route is not accessible. Places where animals are to be taken should be decided in advance and arrangements made with the owners of these places to accept the animals. Trucks, trailers, and other vehicles should be obtained in advance and the animals acclimated to them so they are not frightened when they have to be used. Restraint equipment, feed and water supplies should be available to use and move with the animals and sufficient people should be on hand to help move them. The animals should be photographed and permanently identified by metal eartag, tattoo, brand, registration papers, or microchip. A permanent record of the identification must be kept as this information is useful in resolving arguments of ownership in case animals gets loose. Papers documenting the identification should be kept with other important papers. Ultimately, the decision to evacuate will depend on the distance to be traveled, the amount of time before the disaster will affect the farm, and whether there is any advantage to moving the animals to the place selected. Sometimes evacuation may be done after the disaster, provided the roads are passable and the equipment needed for travel usable. If this is the case, the accepting location must be contacted to find out its condition.

Sheltering

Whether to move farm animals to shelter or leave them outside will depend on the integrity and location of the shelter being used and the type of disaster. During Hurricane Andrew, some horses left outside suffered less injury then those placed in shelters. This was because some shelters selected did not withstand the high winds. Horses were injured by collapsing structures and flying objects that may have been avoided on the outside. Another reason for possibly leaving animals unsheltered is because flood waters that inundate a barn could trap animals inside, causing them to drown. During severe winter weather, shelter animals from icy wind, rain, and snow. Generally, if the structure is sound, the animals should be placed indoors. Once they are inside, secure all openings to the outside. As mentioned previously, the sheltering should be ordered and completed before similar action is taken for humans.

Farm cats and dogs should either be placed in a disaster-proof place or turned loose, as they generally will stay close to their home in the immediate period following a disaster. If they are loose, however, attempts must be made to immediately catchthem after the threat is over to prevent these animals from becoming feral and a public health hazard. Some farm dogs are dangerously aggressive, and under normal circumstances should be kept chained. These dogs cannot be kept chained or turned loose during a disaster. If an inside shelter cannot be found, then the only safe and humane thing to do is to euthanize these dogs as a last measure before evacuation.

Human Evacuation

What can be done with the animals if there is a need to evacuate the premises and the animals have to be left unattended? There is always the risk that animals left unattended for extended periods could die or suffer injury. Sometimes, this may be the only option to protect human life. Protecting human life should always take priority in planning. Regardless, after the animals are secured in appropriate shelters, food and water should be left for them. The amount necessary for survival is considerably less than for other purposes. If the animals survive, then the decision can be made after the disaster whether it is worth the time and expense to bring them back to their previous condition.

Consult the table as a guide to the amount of food and water to leave. Every practical effort should be made to leave animals with sufficient food and water for their survival--enough for 48 hours should be left. Usually, within that time

the initial effects of the disaster will be over. During the recovery phase, the decision can then be made as to the best way to mount a rescue effort.

Special Considerations

Some practices that may be followed in planning for disasters, especially during the winter, require a special alert. During winter weather it is common to use portable heaters, gritty substances on the floor to prevent slipping, and antifreeze. When using these heaters, be sure they are working properly and are located in an area where there is adequate ventilation. Heaters not working correctly could be a source of carbon monoxide, a deadly, odorless, colorless gas. Antifreeze used in vehicles is a deadly poison. Animals seem attracted to it and will readily consume it because of its sweet taste. Take care to properly label all containers. Do not use containers previously filled with antifreeze for other purposes, especially feed and water. Promptly clean up all leaks and spills. Water supplies should be checked for freezing. Many animals have died of thirst during the winter, even with abundant water sources, because they could not drink the water as it was frozen solid. If gritty material is spread on floors to prevent slipping, use only approved nontoxic materials. Recently, a farmer mistakenly used Furadan, a fungicide, for this purpose and several cows who licked it off the floor died.

Farms can be insured against catastrophic events. Insurance policies are available for replacement of damaged materials, repair work for recovery, boarding of evacuated occupants and animals, lost production, and relocation. These should be investigated and purchased before the disaster threatens. For a farmer to claim compensation for lost production, which in many cases is the largest economic cost during a disaster, the farmer must have substantial records that document the level of production his/her herd has achieved in previous years. This is generally only successful in herds with recognized herd monitoring programs, such as Dairy Herd Improvement or other programs that are available for various species. To verify the validity of these records a herd health program, based on a valid veterinarian-client-animal relationship, should be in place. A copy of all production records should be kept in a secure place so that the details are not lost during the disaster. Many veterinarians are willing to keep copies of their clients' production records, if they are computerized and space efficient.

Conclusion

Depending upon the event, disaster preparation may or may not be successful. However, it is known that effects of disasters are lessened by proper planning. Economically, it is cheaper to prevent the problem or lessen its effect than to pay the costs of recovery. The time to do this is NOW, before the disaster occurs.

ANIMALS	WATER/DAY	FEED/DAY
DAIRY COWS		
IN PRODUCTION	9 GALLONS SUMMER	20 POUNDS HAY
	7 GALLONS WINTER	
DRY COWS	9 GALLONS SUMMER	20 POUNDS HAY
	7 GALLONS WINTER	
WEANING COWS	6 GALLONS SUMMER	8-12 POUNDS HAY

	3 GALLONS WINTER	
PREGNANT	7 GALLONS SUMMER	10-15 POUNDS LEGUME HAY
	6 GALLONS WINTER	
COW WITH CALF	9 GALLONS SUMMER	12-18 POUNDS LEGUME HAY
	8 GALLONS WINTER	
CALF (400 POUNDS)	6 GALLONS SUMMER	8-12 POUNDS LEGUME HAY
	4 GALLONS WINTER	
SWINE		
BROOD SOW WITH LITTER	4 GALLONS SUMMER	8 POUNDS GRAIN
	3 GALLONS WINTER	
BROOD SOW (PREGNANT)	1-2 GALLONS SUMMER	2 POUNDS GRAIN
	1 GALLON WINTER	
150 POUND GILT OR BOAR	1 GALLON	3 POUNDS GRAIN
SHEEP		
EWE WITH LAMB	1 GALLON	5 POUNDS HAY
EWE, DRY	3 QUARTS	3 POUNDS HAY
WEANING LAMB	2 QUARTS	3 POUNDS HAY
POULTRY		
LAYERS	5 GALLONS/100 BIRDS	17 POUNDS/100 BIRDS

BROILERS	5 GALLONS/100 BIRDS	10 POUNDS/100 BIRDS
TURKEYS	12 GALLONS/100 BIRDS	40 POUNDS/100 BIRDS
HORSES		
ALL BREEDS	5 GALLONS/1000 POUNDS	20 POUNDS HAY/1000 POUNDS
DOGS AND CATS		
ALL BREEDS	1 QUART/DAY/ANIMAL	AD LIBITUM DRY FOOD

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Descriptors: hazard categories, risk assessment, resources for emergency planning, list of criteria to follow when analyzing a facility and preparing a response, check lists, laboratory personnel, coordinating response, planning the facility program.

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NAL call number: 41.8 Am3
Descriptors: veterinarians, disasters, emergencies, planning, responses, coordination of relief efforts, not specifically for animal facilities but may be useful for universities with large laboratory animal, agricultural, or veterinary facilities.

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NAL call number: SF951.J65
Descriptors: farms, disasters, farm planning, local planning, transport of animals, fires, legislation, telecommunications.

Leonpacher, R.J. (1991). **Disaster planning in animal facilities.** *AALAS Bulletin* 30(6): 20-21.
NAL call number: SF405.5.A23
Descriptors: disasters, laboratory animals, designing a plan, damage or destruction of building contents even though the building is still sound, loss of communications, loss of access, loss of utilities--electrical supply, water, steam, gas, drainage, key elements in disaster plans.

University of California (1998). ***Division of Agriculture and Natural Resources Guide to Disaster Preparedness Resources.*** D. Klingborg, D. Dawson, and S. Donahue (eds.), Davis, California: Veterinary Medical Extension, University of California at Davis, 60 p. Available at http://www.vetmed.ucdavis.edu/vetext/INF-DI_DANRGuide.html
Descriptors: overview of emergency services in California, guide to roadblocks and fire designations, standardized emergency management system, articles, training manuals, workshops, videotapes and other information resources, disaster planning--a comprehensive look at developing a response program, contacts in California, emergency contacts in California--includes animal transporters, animal shelters, feed and supply stores, pet stores, veterinary personnel, sample animal care guidelines and forms.

Vogelweid, C.M. (1998). **Developing emergency management plans for university laboratory animal programs and facilities.** *Contemporary Topics in Laboratory Animal Science* 37(5): 52-56.
NAL call number: SF405.5.A23
Descriptors: creating your plan, establish a planning team and obtain authorization to develop the plan, analyzing response capabilities and identifying specific hazards that are likely to effect an animal facility, develop your plan, include proper authorities--fire, police, environmental safety, community outreach, recovery and restoration of services, implementing the plan, training.

Useful World Wide Web Sites

American Red Cross Disaster Services
http://www.redcrosslv.org/disaster.html
The mission of American Red Cross Disaster Services is to ensure nationwide disaster planning, preparedness, community disaster education, mitigation, and response that will provide the American people with quality services delivered in a uniform, consistent, and responsive manner.

Federal Emergency Management Agency (FEMA) Virtual Library and Electronic Reading Room
http://www.fema.gov/library/
Pertinent resources include full-text documents in the following categories:

Animals in Emergencies
Preparedness, training, and exercises
Response and recovery
U.S. Fire Administration

The online library of FEMA contains full-text resources for planning your disaster response program. Also includes information in Spanish. An excellent resource provided by the Federal Government.

Florida Animal Disaster Planning Advisory Committee
http://www.fl-adpac.org/
ADPAC is an ad hoc group of organizations and individuals interested in promoting the effective development and implementation of disaster plans to protect animals.

University of Colorado Health Sciences Center Animal Care & Use Program
http://www.colorado.edu/VCResearch/integrity/animalcare/index.html
This document is designed to do the following: Guide you during emergencies; Inform you of potential emergency situations before an emergency occurs; and Help you to avoid and anticipate dangerous situations. To access this site, scroll down the left frame and click on After Hours Emergencies/ Disaster Prep.

University of Florida Emergencies
http://www.health.ufl.edu/acs/emergency.htm
The Animal Resources Branch is responsible for emergency planning and implementation with regard to the research animals. This manual will serve as an annex to the University of Florida Natural Disaster/Hurricane Emergency Plan in addition to other Emergency Procedures (i.e. fire, flood, threats by animal activists, etc.) as established by the University of Florida.

University of Florida Institute of Food and Agricultural Sciences and the Florida Cooperative Extension Service
http://disaster.ifas.ufl.edu/
The Disaster Handbook Web site is one component of the Comprehensive Disaster Preparedness and Recovery Education Module, which also includes: The Disaster Handbook (Print and CD-ROM Editions) and "Are You Ready?" a video based on the Disaster Preparedness Satellite Video conference.

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Animal Welfare Laws, Legislation, and Regulations

A Brief Literature Review

- Thirty Years of the Animal Welfare Act
  (links to the article previously published in the Animal Welfare Information Center Newsletter)
- Validation of *in Vitro* Methods: Regulatory Issues
  (links to the article previously published in the Animal Welfare Information
- Bibliography
- Useful World Wide Web Sites

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Useful World Wide Web Sites

Animal Welfare Information Center, Government and Professional Resources / Laboratory Animals

APHIS Press Releases
http://www.aphis.usda.gov/wps/portal/aphis/newsroom/news
Press releases on APHIS programs are prepared by Legislative and Public Affairs (LPA) writers within APHIS and are issued to the media nationally by the Department and regionally or to specialized audiences by APHIS.

ALN Magazine
Animal Lab Magazine Regulations:
Regilations and stadards, Safety, Transportation and related topics.
Moshe's Regulation Updates
Monthly updates of animal welfare regulations.

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Last updated June 18, 2014

International Perspectives on the Animal Care Committee

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Regulation of Animal Research in Selected European Countries

The following information is generously provided by the European Biomedical Research Association. Their website may be accessed at http://www.ebra.org

Animal Experimentation Legislation in The Netherlands

Under the Dutch Animal Experimentation Act (1977) the heads of research establishments can apply to the Ministry of Welfare, Public Health and Cultural Affairs to be issued with a licence to perform animal experiments. When applying for such a licence, they must specify what type of animal research will be conducted in the institution, but there is no specific control of individual research projects involving animals. The Ministry must normally give a decision on the application within two months and a notice about the licence, the purposes of the experiments and the conditions applied to them is published in the Netherlands Government Gazette. There is no specific limit to the duration of a licence.

Each institution is required to appoint a veterinary surgeon or other qualified expert in animal welfare who is responsible for supervising the welfare of the laboratory animals. In addition this person has wide powers to check that the provisions of this Act are being correctly observed. They make an annual report to the licence holder and to the Chief Veterinary Inspector.

The person responsible for determining the way that an animal experiment is performed must hold a doctoral degree in biology, medicine, veterinary medicine or dentistry and to have completed a specified course on laboratory animal science. There are specific requirements for the expertise and training of persons conducting animal experiments or

looking after the animals, the size and construction of cages, the cleaning and heating of animal houses and the feeding of the animals.

Laboratory animals have to be obtained from a licensed animal breeder or animal research institution. They must be housed and cared for and handled so as to satisfy, as far as possible, their physiological and ethological needs. No animal experiment can be conducted for a purpose which, according to a consensus of expert opinion, could be achieved without using animals. No experiment can be conducted on a monkey, dog, cat or horse if another species would suffice. Anesthetics are required where the animals might otherwise suffer appreciable pain, unless these would defeat the object of the experiment. Detailed records must be kept of all the animal experiments conducted.

The legislation instituted an Animal Experiments Advisory Committee, composed of experts on animal research and animal welfare, which is consulted about any general administrative orders concerning animal husbandry, record-keeping, training, etc. In addition, the committee may offer advice of its own volition.

The enforcement of the Act is the responsibility of the Veterinary Public Health Inspectorate, which has an Animal Experimentation Department of six staff. They can enter any animal research premises, take samples, examine animals and require researchers to provide information or copies of records. Any misdemeanors have to be reported to the public prosecutor. This legislation is currently being amended. The main change which the amendments will introduce will be a requirement for local anima l ethics committees, including external lay representatives, at each animal research institution. The exact role and powers of these committees is not yet known.

New Legislation in The Netherlands

On 5 February 1997, a revised Experiments on Animals Act came into force in the Netherlands. The original Act, dating from 1977, was reviewed in the EBRA Bulletin in July 1995 (see above).

Under that legislation, the Ministry of Welfare, Public Health and Cultural Affairs could grant a licence to the head of a scientific institution on the basis of an application describing the type of animal experimentation to be performed. However, there was no external control of individual research projects. Each institution had to appoint an animal welfare officer to supervise the well-being of the animals. In addition, the person responsible for determining the way in which an animal experiment was performed had to hold a doctoral degree in a relevant subject. The law also contained other provisions based on the EU Directive 86/609.

The main change introduced by the revised Act is to require that research plans must be approved by an ethical review committee, which has to consider the benefit to come from the experiments and whether this justifies the distress caused to the animals to be used. No maximum duration for a research plan is stipulated. Committees are required to give a decision on an application within three months and, if they do not approve the research plan, the applicant can appeal to the central animal review committee established under the previous legislation.

Although it is not stipulated in the revised Act, it appears likely these would be local ethical review committees, specific to larger establishments. Smaller research establishments might need to use the committees set up at larger establishments. The structure of these committees is defined in the new Act which requires that they have at least seven members made up from equal numbers of experts in i) animal experiments, ii) alternative methods, iii) animal welfare, and iv) ethical assessment. At least two members must not be conducting animal experiments and at least three members, including the chairperson, must not be employed by a scientific institution applying to the committee.

The ethical review committees must be recognized by the Minister, who will be advised by the central animal review committee. This mechanism is to ensure they operate properly and, for the same purpose, all committees are required to submit an annual report to the Minister. An obligation of confidentiality is placed upon members of these committees with respect to information provided to them.

One addition to the legislation which has been discussed by many observers is the requirement to recognize the intrinsic value of animal life. However, the Act only states that "Any right accorded by or pursuant to this Act shall be exercised in recognition of the intrinsic value of animal life." It is noticeable that the ethical review committees are not required

to take this point into account when assessing research plans.

Additional provisions introduced by the revised Act ban the LD50 and LC50 tests, but permit an exemption to be granted if it can be shown that the experiment cannot be performed by any other method. The testing of cosmetics and cosmetic ingredients is completely banned. Licensing for animal breeders and suppliers is required, applying similar provisions to those for animal use establishments.

The fact that the previous Act did not require the licensing of breeders and suppliers would mean that the Netherlands was not properly implementing the Directive 86/609 which requires such registration. It was obviously important for this to be corrected. The introduction of a system of research plan review based on the cost-benefit principle was also a positive move, bringing the Dutch system closer to that operating in the UK and Germany. However, with the introduction of a ban on the LD50 and an absolute ban on cosmetic testing, the Netherlands system has now gone significantly further than any other EU country. Naturally, much will depend on how the new Act is implemented but, on the basis of the written legislation, this appears to introduce a significantly tighter system of regulation in the Netherlands.

The Regulation of Animal Research and Testing in the United Kingdom

The British system for regulating the use of animals in experiments is defined by a law passed in 1986 called the Animals (Scientific Procedures) Act. The main principle of this law is the requirement for researchers to obtain personal and project licences and a certificate for the establishment where the animal experimentation is conducted. [Ed. Note: A revision to the text of the Animals (Scientific Procedures) Act, which came into effect in September 1998, makes clear the requirement that a project licence applicant must be aware of the possibilities of implementing any of the Three Rs (refinement, reduction and replacement of animal use) within the proposed study. One of the ways in which this awareness may be demonstrated is by documenting the literature searches which have been conducted in the course of planning the study.]

The legislation covers all vertebrate animals and has recently been extended to include the octopus. Anyone wanting to use any of these animals for a scientific purpose that might cause it distress, suffering or permanent harm must seek the necessary licences before commencing any animal work. There is a general exemption for animals which are humanely killed (using a method specified by the legislation) before being used in any experimentation or other procedure. Most of the normal laboratory species are required to be obtained from breeding or supplying establishments holding a certificate under this Act. Cats and dogs are required to be obtained directly from a certified breeder.

The personal licence lists the techniques the person is permitted to use on animals. Every time the researcher needs to use a new technique, the licence must be amended. The certificate for the establishment is given to a named person who is legally responsible for ensuring that the Act is properly enforced in the establishment. This person is normally the most senior person in charge or their deputy. They are required to have one named person (usually the chief animal technician) responsible for the care and welfare of the animals on a day-to-day basis. They are also required to have a named veterinary surgeon permanently on call.

A similar certificate is required by any premises breeding or supplying animals for scientific procedures. The standards of animal care and husbandry required in research, breeding and supplying establishments are defined in Codes of Practice publishe d by the Home Office.

The project licence is held by the senior investigator in charge of a particular project or programme of testing. To apply

for this licence they have to describe the scientific purpose behind the research project or testing scheme, the numbers and types of animals to be used, the procedures which the animals will go through and what steps have been taken to reduce the number of animals and any distress, suffering or harm involved. Project licences are valid for up to five years. All procedures within a project licences are assigned a severity limit - either mild, moderate or substantial. No animal procedure used under a project licence should exceed the severity limit unless an alteration to the licence has been agreed by the Inspector.

Applications for project licences are submitted to the Home Office which has a team of approximately 20 Inspectors (who must hold medical or veterinary qualifications and have relevant experience or training). These Inspectors will assess the application and may require it to be modified before granting the project licence. Home Office Inspectors pay unannounced visits to research establishments to ensure that researchers comply with their licences. They have the power to modify or suspend licences including, if necessary, the power to immediately suspend the certificate for an entire research establishment, halting all animal work.

Before a person is granted a personal licence, they are required to complete a specified training course normally lasting two or three days. A similar training requirement for all first-time applicants for project licences started in April 1995.

Project licence holders are required to keep detailed records of all animals used which are then reported annually to the Home Office. These annual statistics are published showing the numbers and types of animals used as well as the purposes for whic h they were used and the type of establishment using them.

A national committee (the Animal Procedures Committee), made up of researchers, veterinarians, doctors, lawyers, philosophers and animal welfarists advises the government about matters concerning the Act. This committee can decide which subjects it will study. It reviews all project licence applications in certain categories (cosmetic testing, tobacco research, etc) and has the power to see any other project licence application.

Although the UK system is complex and considered by some to be too bureaucratic, it is generally accepted by UK researchers as a fair and sensible system. There are some concerns that the Home Office requires too much detail in the project licence application. Since it is very difficult to predict the way that a fundamental research project will develop, researchers may need to submit several requests to vary the project licence to the Home Office which can delay the progress of the research.

Laboratory Animal Research Legislation in Sweden

The Swedish system of regulating animal research comes under a general law controlling animal welfare, the Animal Protection Act and the Animal Protection Ordinance, both of 1988. To appreciate the way in which these regulate animal research, it is necessary to explain the way in which much of the legislation in Sweden operates.

Each Ministry in the Government has a number of National Boards operating under it. The legislation passed by the Parliament deals with the general principles and then delegates the power to create specific regulations to certain National Boards.

Under the Swedish Ministry for Agriculture, there is a National Board for Laboratory Animals which is responsible for setting up seven regional ethical committees. Scientific and medical experts make up half of the membership of each committee with the other half being lay members. Animal welfare representatives can only make up one third of the committee. The Chairman of each committee is a senior lawyer, usually a judge. Detailed rules for the operation of the committees are provided by the National Board for Laboratory Animals. All animal research and testing proposals are considered by these committees which are required to weigh up the importance of the experiments against the animal suffering involved. Projects can be approved for a maximum of three years. Although these committees only have advisory power, their

recommendations are always followed. Animal experimentation conducted without ethical committee approval is illegal under the basic animal welfare provisions of the Animal Protection Act. There is no appeal against the decision of an ethical committee.

All animal research projects require ethical committee approval, including feeding studies, experiments under terminal anaesthesia and the killing of animals to remove tissues for use in vitro biomedical research.

It is worth noting that the Swedish legislation covers all animals, not just vertebrates. There is a general requirement that laboratory animals must be specially bred, but exceptions are granted for most types of animals apart from the normal laboratory species. Wild mammals are included in the exceptions. The re-use of animals in not banned under the Swedish system, but it is taken into account by the ethics committee when they assess the project proposal.

Veterinary inspectors from the local or regional authorities check research establishments to ensure compliance with the committee decisions. Where problems are found, they have the power to force researchers to comply with the committee recommendations or to impose a fine. However, the experimenter can appeal against this to the regional authorities of higher if necessary. In 1990, the law was amended to ensure that the ethical committee decision took precedence over the opinion of the inspector. The amendment ensured that when an animal research project was approved by an ethical committee and performed in accordance with the protocol approved by that committee, the inspector had no legal power to halt the project.

The Laboratory Animal Board is also responsible for the keeping of records and collection of statistical data about the numbers and type of animals used. They are also responsible for the regulation of education and training requirements for experimenters and technicians and funding the development of alternatives methods to the use of laboratory animals.

In the National Board for Agriculture, there is a Department of Veterinary Affairs which has to approve the design of animal research facilities before they are built or before any significant modifications to the buildings are made. It licences the facility when it meets the guidelines for temperature control, humidity, cage sizes, etc. Each facility is required to appoint a supervisor, a person in charge of animal research for the facility who must be approved by the National Board of Agriculture. This Board also registers and approves laboratory animal breeders and suppliers.

All animal researchers, technicians and animal care[givers] are required to undergo training within two years of starting working with animals. Until they have completed this training and passed a test on it, they are required to work under supervision. The National Board for Laboratory Animals has set out a number of subjects which must be covered by the training, although no formal curriculum or duration of training is stipulated.

The National Board for Laboratory Animals also creates regulations about the recording of animal experiments and the reporting of statistical data. Regulations also cover the way that certain procedures must be conducted. These include immunizations, the production of monoclonal antibodies and acute toxicity testing.

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Noach, E.L. (1995). **Ethical assessment of biomedical experiments in The Netherlands (Ethische beoordeling van biomedische experimenten in Nederland).** *Verhandelingen-Koninklijke Academie voor Geneeskunde van Belgie.* 57 (3): 158-182.
Abstract: The ethical evaluation of biomedical experiments is loyally accepted in the Netherlands. It was introduced everywhere during the last 15 years. Among the targets we find not only the protection of the experimental objects--animals and humans-- but also the protection of researchers who may find moral support in the approval of their projects by a Committee of Ethical Evaluation. Concerning experiments in animals, the legal framework is provided by the Law on Animal Experiments. This law was drawn up in accordance with the directive of the E.U. To be allowed to practice experiments in animals, an institute must possess a licence; the researchers are moreover obliged to be appropriately trained with regard to experiments in animals. To that end an adequately functioning organization has been set up. The intensive supervision is widely decentralized and effected for the greater part by experts working within the institutes. The "intra muros" Committees supervising the experiments in animals play an important part in the ethical evaluation. More than 50 of those Committees are active at this time. Setting the ethical standards is done in close collaboration between the Authorities and the researchers. Researchers and animal protection associations have established a "Platform for the Replacement of Experiments in Animals", in which they support development of alternative methods for research. The legislation concerning medical experiments in humans is not yet completely enforced, but in practice the ethical evaluation has been effected for many years in every hospital of the Netherlands. At present about 150 "Committees for medico-ethical evaluation" are at work. Their task may be very heavy, especially in the academic hospitals, where, mostly, over 150 projects are advised on every year. Adequate training facilities are provided for the members of the committees. The passing of the bill on experiments in humans is stagnating owing to political reasons. Besides the approval of the present practice, the bill-draft contains some elements that are difficult to accept by researchers; among other things, the researchers refuse a possible political influence on the ethical advice. Moreover, there exists a menace to see the insurers changing their rules: the legislation on privacy might also hamper the development of a research seeming too closely patient-linked. Sufficient attention is not given to the financial aspects of the evaluation-process. The real cost of the evaluation should be incorporated into the budget of research projects.
Descriptors: animal testing alternatives, legislation and jurisprudence, ethics committees, human experimentation, Netherlands.

Nomura, T. (1995). **Laboratory animal care policies and regulations: Japan.** *ILAR Journal* 37 (2): 60-61.
NAL call number: QL55.A1I43
Descriptors: animal welfare, laboratory animals, regulations, law enforcement.

Obrink, K.J. and L. Wass (1985). **Compulsory ethical examination of animal experiments. Experiences with the Swedish system.** In: *Proceedings of the 8th ICLAS/CALAS Symposium Vancouver, 1983* New York: Gustav Fischer Verlag, pp. 151-156.
NAL call number: QL55.I55 1983

Descriptors: animal experiments, ethics, ethical committees, compulsory preexamination, Swedish legislation, ACUC.

Perry, M. (1998). **Revised Australian Code of Practice for the care and use of animals for scientific purposes.** *Australian Veterinary Journal* 76 (4): 286.
NAL call number: 41.8 Au72
Descriptors: animal welfare, education, animal ethics committee, scientific animal use, Australian Code of Practice.

Poon, P. (1999) **The use of laboratory animals in Taiwan.** *ANZCCART News* 12(2): 10.
NAL call number: SF405.5.A3
Descriptors: training, animal care and use, laboratory animal production, Laboratory Animal Ethics Committees, Animal Protection Act, public opinion, advocacy for research.

Reid, C.S.W. (1995). **Laboratory animal care policies and regulations: New Zealand.** *ILAR Journal 37* (2): 62-68.
NAL call number: QL55.A1I43
Descriptors: animal welfare, laboratory animals, regulations, law enforcement.

Rodgers, L. and R. Tremont (1992). **Australian researchers take on animal rights.** *New Scientist* May 16, 1992 134 (1821): 37.
NAL call number: 472 N42
Descriptors: animal welfare, animal experiments, ethics.

Rose, M. (1996). **Striking the balance: the practitioner and the animal ethics committee.** *ANZCCART (Australia and New Zealand Council for the Care of Animals in Research and Testing) News* 9(3): 1-3.
NAL call number: SF405.5.A3
Descriptors: legislation, veterinary profession, laboratory animals, animal welfare.

Rowsell, H.C. (1986). **Regulation of animal experimentation: Canada's program of voluntary control.** *Acta Physiologica Scandinavica* 554: 95-105.
NAL call number: QP1.A2
Descriptors: animal welfare, animal testing alternatives, animal welfare history, history of medicine, pain, peer review.

Rowsell, H.C. (1987). **Program and objectives of the Canadian Council on Animal Care.** *Laboratory Animal Science* 37(special issue): 24-25.
NAL call number: 410.9 P94
Descriptors: animal welfare, pain, prevention, legislation, protection, animal testing alternatives.

Rowsell, H.C. (1980). **The voluntary control program of the Canadian Council on Animal Care.** *Journal of Medical Primatology* 9(1-2): 5-8.
NAL call number: QL737.P9J66
Descriptors: laboratory animals, ethics, research, ACUC.

Scharmann, W. (1994). **Housing of laboratory animals and animal welfare legislation: a critical evaluation of current guidelines. [Tiergerechte Haltung von Versuchstieren: Kritische Bewertung der geltenden Richtlinien.]** *Tierarztliche Umschau* 49(9): 552, 555-560.
NAL call number: 41.8 T445
Descriptors: rats, mice, rabbits, guinea pigs, caging, housing, European Union, experiments, animal welfare, guidelines, legislation and regulations.

Swiss Academy of Medical Sciences and Swiss Academy of Sciences (1992). **Ethical principles and guidelines for scientific experiments on animals.** *Experientia* 48(1):1-3.
NAL call number: 475 EX7
Descriptors: animal welfare, animal experiments, guidelines, professional ethics.

Townsend, P. and D.B. Morton (1995). **Laboratory animal care policies and regulations: United Kingdom.** *ILAR Journal* 37 (2): 68-74.

NAL call number: QL55.A1I43
Descriptors: animal welfare, regulations, law enforcement, laboratory animals.

Wong, J. (1995). **Laboratory animal care policies and regulations: Canada.** *ILAR Journal* 37 (2): 57-59.
NAL call number: QL55.A1I43
Descriptors: animal welfare, laboratory animals, regulations, law enforcement, organizations.

Useful World Wide Web Sites

Animals (Scientific Procedures) Act - 1986
https://www.gov.uk/government/publications/guidance-on-the-operation-of-the-animals-scientific-procedures-act-1986
From the United Kingdom Home Office--full text, plus amendments and guidance notes.

The Animal Welfare Act and the Animal Welfare Ordinance (Sweden)
http://www.sweden.gov.se/sb/d/10158/a/90310
Made available by the Swedish Fund for Research Without Animal Experiments.

The Dutch Experiments on Animals Act
http://www.nca-nl.org/
Provided by the Netherlands Center for Alternatives-in English.

European Convention for the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes ETS no.: 123
http://eur-lex.europa.eu/smartapi/cgi/sga_doc?smartapi!celexapi!prod!CELEXnumdoc&numdoc=21999A0824(01)&model=guichett&lg=en
The Convention is designed primarily to reduce both the number of experiments and the number of animals used for such purposes. It encourages Parties not to experiment on animals except where there is no alternative. All research into alternative methods should be encouraged. Animals to be experimented on should be selected on the basis of clearly established quantitative criteria and must be well cared for and spared avoidable suffering whenever possible. To this end, the Convention lays down a number of principles which are to be considered only as a starting point. The Parties meet regularly to examine the application of the Convention and, if appropriate, to extend or strengthen its provisions.

Laboratory Animals--Articles to Download
http://www.lal.org.uk/onlinerep.html
This site provides access to many Working Party Reports, FELASA reports, and scientific papers from European scientists.

Legislation Worldwide
http://www.frame.org.uk/page.php?pg_id=65
From FRAME in the United Kingdom.

Norwegian Regulation of Animal Experimentation (Forskrift om forsøk med dyr)
http://oslovet.veths.no/statute.html
Pronounced by the Ministry of Agriculture, January 15, 1996, in accordance with the Animal Welfare Act of December 12, 1974, nr 73, §§ 22 and 30, after royal proclamation of 19.11.76, amended November 17, 1998.

University of Melbourne
http://www.research.unimelb.edu.au/animalethics/home
The homepage of the Animal Experimentation Ethics Committee containing guidelines, policies and recommendations.

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