About this Document ................................................................. iii
Aquatic Animals ........................................................................ 1
Birds .......................................................................................... 4
Dogs and Cats ........................................................................... 9
General .................................................................................... 15
Livestock .................................................................................. 31
Reptiles ................................................................................... 41
Rodents and Rabbits ............................................................... 43
Wildlife: Captive and Free-ranging .......................................... 54
About this Document

A bibliography pertaining to the humane euthanasia of animals.

The 2007 American Veterinary Medical Association (AVMA) Guidelines on Euthanasia\(^1\) divide euthanatizing agents into three groups: inhalant agents, noninhalant pharmaceutical agents, and physical methods. Within these guidelines, euthanasia is defined as “the act of inducing humane death in an animal.” According to the Web site of the National Centre for the Replacement, Refinement, and Reduction of Animals in Research (NC3Rs),\(^2\) humane death in an animal is one that “occurs with minimal pain and distress; achieves rapid unconsciousness and death; requires minimum restraint; avoids excitement; is appropriate for the age, species, and health of the animal; minimizes fear and psychological stress in the animal; is reliable, reproducible, irreversible, simple to administer and safe for the operator; and, so far as possible, is aesthetically acceptable for the person(s) involved.” One particular inhalant agent that has been the subject of considerable debate is carbon dioxide (CO\(_2\)). The report from the 2006 Newcastle Consensus Meeting on Carbon Dioxide Euthanasia of Laboratory Animals\(^3\) provides a summary of points by experts on the problems associated with euthanasia using CO\(_2\), good practice for CO\(_2\) euthanasia, alternative gaseous euthanasia agents, and directions for future research. Additional information on humane endpoints and euthanasia are provided on the AWIC Web site\(^4\) and updated as needed.

This publication updates Special Reference Briefs Series, SRB 98-01, Animal Euthanasia (http://www.nal.usda.gov/awic/pubs/oldbib/srb9801.htm). It is divided into 8 groups as follows: Aquatic Animals, Birds, Dogs and Cats, General, Livestock, Reptiles, Rodents and Rabbits, Wildlife: Captive and Free Ranging. The sources of information which were published between the years 1995 to September 2007 include peer-reviewed journals, conference proceedings, theses, annual reports, dissertations, books, monographs, letters, Web pages, reviews, and patents.

Each citation in the bibliography contains descriptor terms, an abstract when available, and the NAL call number if the particular source is available at the National Agricultural Library (NAL). Information on how to request materials that are included in the collection of the NAL may be found at: http://www.nal.usda.gov/services/request.shtml.

Readers are cautioned as to the dynamic nature of the internet and the fact that Web addresses and content are subject to change. All sites are current as of November 2007.

References
\(^2\) Euthanasia, National Centre for the Replacement, Refinement and Reduction of Animals in Research (NC3Rs) - http://www.nc3rs.org.uk/category.asp?catID=15
\(^3\) 2006 Newcastle Consensus Meeting on Carbon Dioxide Euthanasia of Laboratory Animals - http://www.nc3rs.org.uk/downloaddoc.asp?id=416&page=292&skin=0
Aquatic Animals


**Descriptors:** cetacea, euthanasia, analgesics, etorphine, methotrimeprazine.


**NAL Call Number:** SF77.C65

**Abstract:** Potassium chloride (KCl: 330 mg/ml) was assessed as an euthanasia agent in American lobsters (*Homarus americanus*). Two groups of 10 lobsters (408.2 to 849.9 g) were maintained at 11.9 to 12.1 degrees C ('warm') and 1.5 to 2.5 degrees C ('cold') to evaluate the possible effect of ambient temperature on response to KCl. Death was defined as time of cardiac arrest, as viewed and measured by use of ultrasound. The KCl solution was injected (100 mg of KCl/100 g of body weight) at the base of the second walking leg to flood the hemolymph sinus containing the ventral nerve cord with potassium. Disruption of this 'central nervous system' was immediate, followed by cardiac arrest within 60 to 90 seconds. Group median (+/- SD) baseline heart rate was 42 +/- 14 'warm' and 36 +/- 5 'cold' beats per minute. Time until cardiac arrest ranged from 35 to 90 (57 +/- 18) seconds in the 'warm' group and from 40 to 132 (53 +/- 34) seconds in the 'cold' group. There was no significant difference between group medians for either parameter. Histologic lesions were limited to mild to moderate acute degeneration, characterized by cell swelling, loss of contraction bands, and occasional mild cytoplasmic vacuolation of skeletal muscle at the injection site. Injectable KCl solution was an effective, reliable method for euthanasia of *H. americanus.*

**Descriptors:** euthanasia methods, potassium chloride, abdominal muscles, heart rate, histocytochemistry temperature, ultrasonography, American lobsters, *Homarus americanus.*


**Descriptors:** fishes, CO2 euthanasia, carbon dioxide, toxicity testing.

**Language of Text:** Czech, Summary in English.


Descriptors: cetaceans, killing techniques, stranded animals, euthanasia.


NAL Call Number: 41.8 N483

Descriptors: Delphinus delphis, Globicephala melaena, euthanasia techniques, stranded animals, shotgun usage.


Descriptors: amphibians, reptiles, literature review, euthanasia methods.

Language of Text: Dutch, Summary in English.


Descriptors: fish, animal welfare, anesthetics, euthanasia, animal care.


Descriptors: philosophy, ethics, euthanasia, killing techniques, cetaceans, whales, whaling.


Descriptors: fish, amphibians, reptiles, killing techniques, euthanasia methods.


NAL Call Number: QL77.5.R37


NAL Call Number: 41.8 R3224

Abstract: A stranded juvenile fin whale was successfully euthanized with an intravenous injection of sedative and cardioplectic drugs. Veterinarians may face a number of serious difficulties if called to perform this task, and advance preparation is required for successful euthanasia of these animals.

Descriptors: euthanasia, mepivacaine, whales, Prince Edward Island.

NAL Call Number: QL713.2.M372

Descriptors: fin whales, euthanasia, *Balaenoptera physalus*, use of multiple euthanizing agents.


Descriptors: animal welfare, barbiturates, capture of animals, carbon dioxide, carcass disposal, euthanasia, explosives, inhaled anesthetics, injectable anesthetics, potassium chloride, cetaceans, pinnipeds, whales, dolphins, seals, sea lions.

Notes: Available from AAZV.


Descriptors: marine mammals, euthanasia techniques.


Descriptors: anesthesia, animal welfare, aquaculture, aquarium fishes, euthanasia, immobilization, pain, regulations, fishes.

Notes: Available from the AAZV.


NAL Call Number: 41.8 V641

Descriptors: euthanasia, whales, Falkland Islands.


Descriptors: anesthesia, animal welfare, euthanasia, restraint of animals, sea otters.

Notes: Available from AAZV.


Descriptors: amphibians, euthanasia techniques, literature overview, physical restraint, sedation, anesthesia, husbandry.

**Descriptors:** disease outbreaks, hygiene, influenza in birds, zoonoses, birds, animal euthanasia.

**Language of Text:** Dutch.


**Abstract:**

**Descriptors:** animal welfare, birds, euthanasia, veterinary.


**NAL Call Number:** 47.8 W89

**Descriptors:** broilers, turkeys, anesthesia, euthanasia, consciousness, carbon dioxide, oxygen, nitrogen, animal behavior, death, animal welfare, heart rate, animal use, refinement, electroencephalograms, controlled atmospheres, stunning, animal distress.


**Descriptors:** chickens, euthanasia, animal ethics, influenza in birds, animal welfare.


**Abstract:** In this article firstly the standards of the killing methods of poultry because of animal diseases and the parameter for the choice of a method are described. The following part deals with the effects of the different killing methods. Finally the most important control points during the killing of poultry are discussed.

**Descriptors:** animal welfare, disease outbreaks, euthanasia, poultry diseases, disease outbreaks prevention and control, poultry.

**Language of Text:** German.

Descriptors: chickens, mass euthanasia, animal ethics, infection control methods, carbon dioxide.
Language of Text: Dutch.


**Abstract:** The purpose of this study was to investigate the suitability of gas mixtures for euthanasia of groups of broilers in their housing by increasing the percentage of CO2. The suitability was assessed by the level of discomfort before loss of consciousness, and the killing rate. The gas mixtures injected into the housing were 1) 100% CO2, 2) 50% N2 + 50% CO2, and 3) 30% O2 + 40% CO2 + 30% N2, followed by 100% CO2. At 2 and 6 wk of age, groups of 20 broiler chickens per trial were exposed to increasing CO2 percentages due to the injection of these gas mixtures. Behavior and killing rate were examined. At the same time, 2 broilers per trial equipped with brain electrodes were observed for behavior and brain activity. Ten percent of the 2-wk-old broilers survived the increasing CO2 percentage due to the injection of 30% O2 + 40% CO2 + 30% N2 mixture, therefore this mixture was excluded for further testing at 6 wk of age. At 6 wk of age, 30% of the broilers survived in the 50% N2 + 50% CO2 group. The highest level of CO2 in the breathing air (42%) was reached by the injection of the 100% CO2 mixture, vs. 25% for the other 2 mixtures. In all 3 gas mixtures, head shaking, gasping, and convulsions were observed before loss of posture. Loss of posture and suppression of electrical activity of the brain (n = 7) occurred almost simultaneously. The results of this experiment indicate that euthanasia of groups of 2- and 6-wk-old broilers by gradually increasing the percentage of CO2 in the breathing air up to 40% is possible.

Descriptors: broiler chickens, carbon dioxide, nitrogen, death, consciousness, animal behavior, poultry, housing, distress, gas mixtures, euthanasia.


**Descriptors:** gas mixtures, euthanasia of broilers, poultry housing, CO2, loss of consciousness, animal behavior, killing rate, euthanizing groups of animals.


**Abstract:** Large groups of poultry, including ducks and turkeys, are killed for disease control purposes with CO2. In this study, we examined the physiological reaction of White Pekin ducks and turkeys to increasing CO2 concentrations. Additionally, we examined the suitability of killing both species with increasing CO2 concentrations. Blood gas values showed similar reaction patterns for both species: a strong increase in pCO2 from approximately 40 to 200 mmHg, decreasing pO2 and O2 saturation, a decrease in pH from 7.4 to 6.7, and a strong shift in acid-base equilibrium (averaging...
On the electroencephalogram, theta and delta waves occurred at 21 to 23% CO2, and suppression to a near isoelectric electroencephalogram occurred between 41.8 and 43.4% CO2 in inhaled air. Heartbeat declined from approximately 300 beats per min (bpm) at the start to 225 bpm at loss of posture to 150 bpm at 1 min before the heartbeat ceased. During the last phase of heart activity, an irregular rhythm and fibrillation were observed in addition to a decline in bpm. Blood gas values and electrophysiological data confirmed that ducks and turkeys lose consciousness before a level of 25% CO2 in inhaled air is reached and that both ducks and turkeys die within 13 min in an environment of 45% CO2 in inhaled air.

Descriptors: ducks, turkeys, euthanasia, mortality, carbon dioxide, hypercapnia, hypoxia, blood gases, consciousness, posture, electroencephalography, electrocardiography, Netherlands.


Online: http://www.bioone.org

Descriptors: animal welfare, euthanasia techniques, surgery, birds.


NAL Call Number: 41.8 Am3

Descriptors: poultry, Newcastle disease, avian influenza, disease outbreaks, euthanasia, animal welfare, mortality, anesthesia, carbon dioxide, poultry housing, mass euthanasia.


Descriptors: animal welfare, birds, euthanasia, legislation, ornamental birds, wild birds, veterinary medicine.

Language of Text: German.


Descriptors: injured wild birds, treatment techniques, euthanasia, animal welfare, veterinary intervention, goals and options.

Language of Text: German, Summary in English and German.

Descriptors: animal welfare, asphyxia veterinary, birds, euthanasia veterinary, thorax.

Descriptors: chickens, broilers, gases, carbon dioxide, argon, nitrogen, inhalation exposure, acute effects, chemical concentration, animal behavior, feeding behavior, animal welfare, euthanasia, controlled atmosphere stunning, gas stunning, aversion.

Descriptors: animal welfare, birds, euthanasia, methodology, wild birds, birds.
Notes: Available from AAZV.

Abstract: Poultry may need to be culled in the event of an outbreak of disease. Gassing has advantages over mechanical and electrical methods or overdoses of anaesthetics because large numbers can be killed simultaneously and little or no handling of the birds is required. However, gaseous killing methods may have welfare implications for the birds, which may find various gases more or less aversive, may undergo respiratory distress and/or experience convulsions, and may remain conscious for a considerable time before they die. In addition, the gases used may present health and safety risks to human operators, and be difficult to supply and deliver.
Descriptors: agriculture methods, disease outbreaks, euthanasia, methods, poultry, poultry diseases.

Descriptors: animal welfare, argon, carbon dioxide, euthanasia of animals, method of slaughter, poultry, stunning.

Descriptors: animal welfare standards, euthanasia, methods, influenza in birds, birds.

Descriptors: animal welfare, ethics, euthanasia, chickens, veterinary medicine.

**Online:** www.agriworld.nl

**Descriptors:** mass culling, birds, disease outbreaks, animal welfare, carbon dioxide, composting, carcass disposal, euthanasia, poultry.


**Descriptors:** anesthesia, animal euthanasia, bird diseases, budgerigar.


**Descriptors:** chickens, broilers, poultry, inhalation euthanasia, stress, animal welfare, carbon dioxide, nitrogen.
Dogs and Cats


**Abstract**: OBJECTIVE: To evaluate the efficacy of trap-neuter-return and trap-euthanatize management strategies for controlling urban free-roaming cat populations by use of matrix population models. DESIGN: Prospective study. SAMPLE POPULATION: Estimates of free-roaming cat populations in urban environments. PROCEDURE: Data from the literature describing the biology of free-ranging cat populations in urban environments were gathered. A matrix population model was developed with a range of high and low survival and fecundity values and all combinations of those values. The response of population growth rate to a range of management actions was assessed with an elasticity analysis. RESULTS: All possible combinations of survival and fecundity values of free-roaming cats led to predictions of rapid, exponential population growth. The model predicted effective cat population control by use of annual euthanasia of > or = 50% of the population or by annual neutering of > 75% of the fertile population. Elasticity analyses revealed that the modeled population was most susceptible to control through euthanasia. CONCLUSIONS AND CLINICAL RELEVANCE: Free-roaming cat populations have a high intrinsic growth rate, and euthanasia is estimated to be more effective at reducing cat populations than trap-neuter-return programs.

**Descriptors**: castration, cats, euthanasia, animal population control methods, population dynamics, program evaluation, prospective studies, survival analysis.


**Descriptors**: animal welfare, euthanasia of livestock, firearms, guidelines. **Language of Text**: Norwegian, Summary in English.


**Descriptors**: animal rescue shelters, animal law, animal welfare, Michigan.


**Descriptors**: euthanasia, animal ethics, legislation, cats, emergency medical services, animal ownership. **Language of Text**: Dutch.

Carpenter, S. (2002). Questions regarding article on pet relinquishments, euthanasiase. *Journal of the American Veterinary Medical Association* 220(7): 963; Author Reply

**Descriptors:** dogs, magnesium sulfate, thiopentone, xylazine, dosage, euthanasia, pulse, respiration rate, urination.


**Online:** www.thepress.purdue.edu

**Descriptors:** coping with death, euthanasia of pets, human behavior, ownership, pets, religion, questionnaire.


**Descriptors:** dogs, cats, euthanasia, animal injuries, behavior problems, England, illness, old age, reasons.


**Descriptors:** pets, euthanasia, emotions, stress, pain, client, team.


**NAL Call Number:** SF985.F4

**Descriptors:** pets, euthanasia, veterinarians, psychological stress, customer relations, cats, distress, pain.


**Descriptors:** euthanasia, pets, professional ethics, animal welfare, dogs.

**Language of Text:** Norwegian, Summary in English.


**Descriptors:** dogs, euthanasia, veterinary medicine, data collection, forms and records, licensure, greyhounds.


**Descriptors:** cats, data collection, dogs, age factors, Canada, animal welfare, attitudes, breeding, euthanasia statistics and numerical data.
Descriptors: euthanasia, pentobarbital, T-61, electroencephalography, respiration, poisoning, euthanasia of animals, dogs, arterial blood pressure, time to collapse, signs of recovery.
Language of Text: Portuguese, Summary in English.

Descriptors: Denmark, dogs as pets, euthanasia because of behavior problems, aggression, animal behavior, bites.
Language of Text: Danish, Summary in English.

Descriptors: dogs, pet animals, destruction of animals, abnormal behavior, sex, age groups, euthanasia.
Language of Text: Danish, Summary in English and Danish.

Abstract: OBJECTIVE: To determine the prevalence of clinical signs that affect quality of life in dogs with congestive heart failure (CHF), and to characterize the role of these clinical signs in the decision for euthanasia. DESIGN: Prospective study. ANIMALS: 38 dogs with CHF that had been euthanatized within the preceding 22 months. PROCEDURE: Clinical information and factors affecting the decision for euthanasia were reviewed and recorded from medical records of dogs with CHF. Each owner was then interviewed via telephone to determine whether their dog had anorexia or other clinical signs of disease prior to euthanasia, their perception of their dogs' quality of life, and the most important factor and contributing factors that influenced the decision to euthanatize their dog. RESULTS: Of the 38 dogs with CHF, > 70% had weakness (35 dogs), coughing (33), anorexia (32), weight loss (32), dyspnea (30), or exercise intolerance (28) reported by their owners. Factors often named by owners as most important in the decision for euthanasia were poor prognosis given by the attending veterinarian, recurrent clinical signs of CHF (ie, coughing, dyspnea, or ascites), and poor quality of life. Weakness, anorexia, and recurrent clinical signs of CHF were the most common contributing factors in the decision for euthanasia. CLINICAL IMPLICATIONS: Anorexia, weight loss, and exercise intolerance are common in dogs euthanatized because of CHF. The importance of quality of life and poor prognosis in making a decision for euthanasia suggests that addressing these factors may improve patient management.
DOGS AND CATS

Descriptors: human-animal bond, dogs, euthanasia, congestive heart failure, quality of life, anorexia, cough, dyspnea, prospective studies, questionnaires, retrospective studies, weight loss.

Descriptors: veterinary practice, owner grieving, veterinarian, veterinary nurse, euthanasia, death of pet.

Descriptors: report, animal hospitals, animal welfare, reasons for euthanasia, German Shepherd, dogs, cats.
Language of Text: Portuguese, Summary in English.

Descriptors: questionnaire study, veterinary medicine, reasons for euthanasia, dogs, behavioral problems.
Language of Text: Danish, Summary in English.

Descriptors: euthanasia, companion animals, legislation, Italy, ethics, veterinary medicine.
Language of Text: Italian, Summary in English.

Descriptors: abnormal behavior, euthanasia, behavior problems, dogs, pet animals, risk factors, size of dog, aggression.
Language of Text: Finnish, Summary in English.

Descriptors: dogs, euthanasia, oral administration, acepromazine, dosage, combination drug therapy, drug effects, neuroleptics, comparison.
Descriptors: veterinary medicine, animal owners, pet animals, euthanasia, moral dilemma, ethics, treatment options.  
Language of Text: German, Summary in English.

Descriptors: animal shelters, companion animals, dogs, cats, euthanasia, shelter personnel.

Descriptors: animal welfare, deafness, dog diseases, ethics, euthanasia, dogs.  

Descriptors: euthanasia, companion animals, veterinary medicine, cats, dogs.  
Language of Text: Italian.

Descriptors: veterinarians, dogs, cats, euthanasia, behavior problems, counseling, gonadectomy, roles.

Descriptors: small animal practice, veterinary medicine, euthanasia, aging animals, dogs, cats.  
Language of Text: German, Summary in English.

Descriptors: animal welfare, euthanasia, breeding, dogs, England, greyhounds.

**DOGS AND CATS**

**Descriptors:** animal welfare, euthanasia, pets, techniques, cats, dogs.

**Language of Text:** Danish.


**Descriptors:** anesthesia, analgesics, animal welfare, euthanasia, laboratory animals, preanesthetic, dogs.


**Descriptors:** euthanasia, pets, veterinarians.

**Language of Text:** English, French.


**Descriptors:** University of Bologna, euthanasia, data collection, private veterinary hospitals, decline in rates of euthanasia, prevalence of disease, vaccination programs.

**Language of Text:** Italian, Summary in English.


**Descriptors:** euthanasia, animal welfare, dogs, pedigree, greyhounds.


**Descriptors:** cats, euthanasia, oral administration, ketamine, dosage, combination drug therapy, drug effects, neuroleptics.
**Animal Euthanasia**

**General**


Descriptors: animals, suffering, euthanasia, owners.


Online: http://www.ajol.info/viewarticle.php?jid=73&id=26274&layout=abstract

Descriptors: animal welfare, euthanasia, small laboratory animals, medulla oblongata, rats, air injection, intramedullary.


Descriptors: animal euthanasia, animal ownership, UK.


Descriptors: animal behavior, carbon dioxide, euthanasia methods, laboratory animals, lidocaine, pentobarbital, animal use refinement.


Online: http://www.avma.org/issues/animal_welfare/euthanasia.pdf

NAL Call Number: 41.8 Am3

Descriptors: euthanasia of animals, animal welfare, veterinary drugs, animal behavior, human health and safety, efficacy.


NAL Call Number: SF601.D3

Descriptors: euthanasia, stress, psychological price, moral.


Descriptors: animal care committees, IACUCs, euthanasia, animal ethics, laboratory animal science, cervical vertebrae injuries, dislocations.

*Descriptors*: animal care committees, euthanasia, laboratory animal science, cervical vertebrae injuries, dislocations.

*Descriptors*: laboratory animals, euthanasia, carbon dioxide, mixtures, animal welfare, air temperature, aluminum, ceramics, laboratory equipment, specific heat, acrylics, bell jar, platform.

*Descriptors*: decision making, euthanasia, urinary incontinence, attitude of health personnel, dogs.

*Descriptors*: attitude of health personnel, euthanasia, veterinary medicine, physician patient relations.

*Descriptors*: palliative care, animal euthanasia, Great Britain.

Bee, D.J. (1996). **Euthanasia of large animals.** *The Veterinary Record* 139(8): 196. ISSN: 0042-4900.
*Descriptors*: euthanasia veterinary, magnesium sulfate, animal welfare.

*Descriptors*: animals, laboratory, carbon dioxide metabolism, euthanasia, animal methods, pain.

*Descriptors*: ethics, euthanasia techniques, drowning, welfare aspects, criticism.

Descriptors: death certificates, euthanasia documentation, veterinary medicine.
Language of Text: Dutch.

Descriptors: animal welfare, euthanasia, chronic disease, dogs.
Language of Text: Dutch.

Descriptors: euthanasia, veterinary medicine, decision making.

Descriptors: euthanasia, ethics, legislation, animal ethics, Great Britain.

Descriptors: euthanasia guidelines, workshop report, laboratory animals, pain, distress, animal behavior, ethics.

NAL Call Number: QL77.5.R37

Descriptors: euthanasia, ethics, legislation, Great Britain.

Descriptors: euthanasia, veterinary medicine practice.

Descriptors: laboratory animals, euthanasia, death, animal experiments, animal welfare.
Language of Text: Romanian, Summary in English and French.

Descriptors: laboratory animals, euthanasia, recommendations, techniques.
Language of Text: Russian.

Descriptors: laboratory animal care, euthanasia, animal handling, cadaver processing, personnel training, carcass disposal.
Language of Text: Russian.

Descriptors: laboratory animals, euthanasia, methods.

Abstract: Performing euthanasia is likely one of the most challenging tasks a veterinarian faces. Four students at Tufts University School of Veterinary Medicine felt that they and their classmates needed additional training on this subject. They informally surveyed their classmates to determine what topics and formats the students desired. The findings were used to develop the Euthanasia Workshop at the university, a voluntary series of lectures and discussions on technical and emotional issues relating to euthanasia. The four students then informally surveyed 30 North American veterinary colleges to determine the scope of euthanasia training in other veterinary programs. They found that euthanasia, while often covered within other courses, is rarely taught as a stand-alone course.
Descriptors: euthanasia of animals, education, veterinary schools, United States.

Descriptors: anesthesia, animal welfare, laboratory animals, livestock, euthanasia techniques.

Descriptors: animal care committees, animal ethics, laboratory animal science,
ANIMAL EUTHANASIA

cervical dislocations, euthanasia methods.

Descriptors: veterinary ethics, euthanasia, decision making, professional patient relations, veterinary medicine.

Descriptors: communication, animal euthanasia, veterinarians, physician-patient relations.

Descriptors: animal care committees, euthanasia, animal ethics, laboratory animal science, cervical dislocations.

Descriptors: animal welfare, ethics, euthanasia, laboratory animals.
Language of Text: French.

Gustafsson, A. and L. Berg (2005). **Avlivning mot djuragarens vilja kan vara skadegorelse. [Euthanasia against an owner's will can be risky]. Svensk Veterinartidning** 57(7): 42-44. ISSN: 0346-2250.
Descriptors: euthanasia, legislation, professional ethics, veterinary profession.
Language of Text: Swedish.

Descriptors: euthanasia, law and legislation, regulations, wildlife conservation, wildlife management, zoo animals.
Notes: Available from AAZV.

Descriptors: animal euthanasia, veterinarians, treatment failure.
Notes: Comment In: Vet Rec. 2007 Jun 30;160(26):915.

**Descriptors:** euthanasia, veterinary jurisprudence, legal aspects.


**Descriptors:** police officers, occupational hazards, wild animals, capture of animals, rabies, aggression, euthanasia, species differences, emergencies.


**Descriptors:** domestic animals, human-pet bonding, euthanasia, veterinarians, dogs.


**Online:** [www.iat.org.uk](http://www.iat.org.uk)

**Descriptors:** animal welfare, carbon dioxide, ethics, euthanasia, laboratory animals.

**Language of Text:** German; Spanish; French; Italian.

**Notes:** Conference Information: Newcastle consensus meeting on carbon dioxide euthanasia of laboratory animals, University of Newcastle upon Tyne, UK, 27-28 February 2006.


**Online:** [http://www.journalvetbehavior.com/article/PIIS155878780700038X/abstract](http://www.journalvetbehavior.com/article/PIIS155878780700038X/abstract)

**Descriptors:** thanatology, veterinary medicine, animal behavior, animal welfare, companion animals, euthanasia, death, pet owners, veterinary guidance, grieving.


**Descriptors:** veterinary medicine, euthanasia, mortality, duration, data collection, costs and returns, morbidity, statistical analysis, errors.


**Descriptors:** decision making, euthanasia, veterinary medicine, attitude of health personnel.

**Notes:** Comment In: Vet Rec. 2000 Jul 22;147(4):116.

**Descriptors:** animal care committees, euthanasia, animal ethics, laboratory animal science, cervical dislocations.

**Notes:** Comment On: Lab Anim (NY). 2004 Sep;33(8):15.


**Descriptors:** dogs, cats, euthanasia, socioeconomic status, abnormal behavior, animal diseases, supply, pets, United States, old age, shelters.


**Abstract:** For euthanasia of pregnant animals, a rapid and painless death is essential. The technique of euthanasia should minimize stress and anxiety experienced by the animal so far as possible. The death is induced by an anoxia in the central nervous system or by a pharmacologic inhibition of essential neuronal functions. Pentobarbital is the best suited drug for euthanasia of animals and especially of pregnant animals. Combinations with muscle relaxing agents should not be used because of possible apnoe without unconsciousness.

**Descriptors:** euthanasia of pregnant animals, hypnotics and sedatives, pentobarbital administration and dosage, chemically induced anoxia.

**Language of Text:** German.


**Descriptors:** animal welfare, euthanasia veterinary, scientific standards, veterinary medicine.


**Abstract:** In this paper there are shown chemical and physical methods of euthanasia of vertebrate animals. All methods are divided into three categories: A) Acceptable methods of euthanasia, B) methods acceptable only for unconscious animals, C) methods that are not acceptable for euthanasia. The acceptability or non-acceptability of the method is determined by ethic or aesthetic conceptions and also by conceptions of the personnel safety and the environment. There is provided a table of acceptable methods of euthanasia. Recommendations of working group of the Federation of Laboratory Animal Science Association (FELASA) were taken into consideration in this paper. The survey can be useful for the experimenters and personnel concerned with laboratory animals.

**Descriptors:** animal technicians, laboratory animals, acceptable methods of...
euthanasia, ethics, primates, survey.

Language of Text: Russian.


Descriptors: euthanasia, occupational hazards, personnel, animals.

Notes: Available from AAZV.


Online: http://www.nal.usda.gov/awic/pubs/oldbib/srb9801.htm

NAL Call Number: aS21.D27S64

Descriptors: animals, destruction of animals, bibliographies.

Notes: Updates AWIC Special Reference Briefs Series no. SRB 93-06.


Descriptors: dogs, cats, horses, pet animals, death, destruction of animals, animal welfare, legislation, anesthesia, euthanasia.

Language of Text: Swedish, Summary in English and Swedish.


Descriptors: ethics, euthanasia techniques, euthanasia by drowning, welfare aspects, reply to criticism.


Descriptors: euthanasia by drowning, physiology evidence, brain, electroencephalogram during drowning, unacceptable euthanasia technique, heart beat, respiratory function.


Descriptors: animal welfare, euthanasia, quality of life, communication, ethics.


Descriptors: animal welfare, ethics, slaughter, euthanasia.

Language of Text: German, Summary in English.

**Descriptors:** animal welfare, animal behavior, euthanasia, pets, veterinary practice, cats, dogs.


**Descriptors:** dogs, animal ethics, euthanasia, bioethical issues, ethics committees.

**Notes:** Comment On: Vet Rec. 2000 Jul 1;147(1):27.


**Descriptors:** animals, slaughter, death, veterinarians, cope, reflection.


**Descriptors:** animal euthanasia, factors, procedures, satisfaction, students, staff, client, veterinary teaching hospital.


**Descriptors:** veterinary medicine, veterinary teaching hospital, small animal euthanasia, methods, pets.


**Descriptors:** pain, distress, euthanasia, pain and distress assessment.

**Language of Text:** Japanese.


**Descriptors:** euthanasia, evaluation, pain, distress.

**Notes:** Meeting Information: 79th Annual Meeting of the Japanese Pharmacological Society, Yokohama, Japan; March 8 -10, 2006.


**Descriptors:** laboratory animals, destruction of animals, regulations, euthanasia.

**Language of Text:** French, Summary in English and French.

**Descriptors:** animal experiments, animal welfare, euthanasia, laboratory animals.

**Language of Text:** French, Summary in English.


**Descriptors:** euthanasia, pain, suffering, comparison of methods, cats.


**NAL Call Number:** 41.8 Am3

**Descriptors:** euthanasia, death, unintentional outcome, stress.


**Descriptors:** veterinary medicine, veterinarians, death and dying, bioethics, pets, euthanasia, animal diseases, terminal illness and injury.

**Notes:** This issue available in photocopy form only.


**Descriptors:** veterinarians, pets, euthanasia, pet care, emotions, human behavior, veterinary medicine, ethics, animal welfare.


**Descriptors:** dogs, working animals, euthanasia, longevity, gender differences, breed differences, dog breeds, causes of death.


**Descriptors:** euthanasia, quality of life, animal welfare, palliative care.

**Notes:** Comment On: J Am Vet Med Assoc. 2001 Nov 1;219(9):1204-6.


**Descriptors:** euthanasia hazards, occupational health, animal euthanasia, chemical methods, psychological effects, training, physical methods.

ANIMAL EUTHANASIA

Descriptors: euthanasia, professional autonomy, veterinary medicine.

Descriptors: disease outbreaks, euthanasia, animal legislation and jurisprudence, zoonoses, France.
Language of Text: French.

Descriptors: veterinary medicine, experimental animals, euthanasia, space research.

Descriptors: veterinary medicine, carcass disposal, legislation, wildlife, euthanasia.

Descriptors: laboratory animals, morbidity, mortality, euthanasia, stress management, psychosocial factors, psychological stress; human animal relations, training officers, laboratory workers, grief.

Descriptors: animal welfare, human-pet bonding, animal euthanasia, ethics, quality of life, pain prevention and control.
Notes: Comment On: J Am Vet Med Assoc. 2006 Apr 1;228(7):1014-.

Descriptors: euthanasia, therapy, animals, veterinary medicine.
Language of Text: Italian.

Descriptors: animal welfare, euthanasia, ethics.
Language of Text: Polish.

Descriptors: endpoints, animal use refinement, general anesthetics, euthanasia, carbon dioxide, laboratory animals.
**Descriptors:** labor, psychological stress, euthanasia, animal rescue shelters, employee reactions.

**NAL Call Number:** SF756.394.R45 2001
**Descriptors:** animals used for scientific purposes, euthanasia of animals, moral and ethical aspects of animal experimentation.

**NAL Call Number:** SF756.394 .R46 2002
**Descriptors:** euthanasia of animals, training manual, Humane Society of the United States, HSUS.

**Descriptors:** zoos and wildlife parks, ethics, care in captivity, euthanasia in zoos.

**Descriptors:** zoos, wildlife parks, euthanasia as management tool, ethics, care in captivity, Scotland.

**Descriptors:** animal shelters, companion animals, dogs, cats, euthanasia, shelter personnel.

**Abstract:** This study explored possible identification of Perpetration-induced Traumatic Stress (PITS) in workers whose occupations required euthanizing nonhuman animals and determining whether event or person-related factors influenced symptoms. The sample included 148 animal workers: veterinarians, veterinary nurses, and research and animal shelter staff. The Impact of Event Scale-Revised (IES-R) assessed traumatic stress. Experimenters constructed additional
scales measuring satisfaction with social support, participation in various types of training, and concern over animal death. More than 70% of participants reported affinity toward animals had strongly influenced their occupation selection. Half the sample perceived animal death—particularly euthanasia—as one of the least desirable jobs. Of the sample, 11% reported experiencing moderate levels of traumatic symptoms. The study found lower levels of euthanasia-related stress were associated with increased satisfaction with social support and length of time working with animals. Those who reported high levels of concern about animal death reported higher levels of euthanasia-related stress. The study found occupational context was not associated with different levels of euthanasia-related stress symptoms—even though reasons for administering euthanasia differed significantly between occupations.

Descriptors: animal technicians, euthanasia, stress disorders, veterinarians, occupational health.

Descriptors: child, euthanasia, animal rights, child, dogs.
Language of Text: French, English.

Descriptors: animal technicians, medical ethics, euthanasia, dogs, employment.

Descriptors: euthanasia, quality of life, bioethics, veterinary medicine, literature reviews, animal welfare, pets.

Descriptors: veterinary medicine, veterinarians, euthanasia, alternative medicine, consent, authority.

Descriptors: animal welfare ethics, euthanasia, veterinary medicine, animals.

Descriptors: animal welfare, ethics, veterinary medicine, domestic animals, laboratory animals.

**Descriptors:** ethics, animal euthanasia, veterinary medicine, animal welfare.


**Descriptors:** animal welfare ethics, euthanasia, veterinarians, health care costs, ownership.


**Descriptors:** animal welfare standards, professional ethics, euthanasia, Canada, cats, dogs, rural areas, sheep.

**Notes:** Comment In: Can Vet J. 1997 Nov;38(11):678.

Rollin, B.E. (1996). *An ethicist's commentary on the case of the veterinarian who euthanized an animal thinking that he had received owner permission.* Canadian Veterinary Journal 37(9): 519-520. ISSN: 0008-5286.

**Descriptors:** domestic animals, medical ethics, euthanasia, veterinary standards, animal rights, Canada, dogs.


**Descriptors:** animal welfare, deafness, dog diseases, ethics, euthanasia, dogs.

**Notes:** Erratum In: Can Vet J 2000 Jul;41(7):537.


**Descriptors:** euthanasia, animal welfare, decapitation, electrocution, guidelines, inhalation and injectable anesthetics, veterinary practice.


**Descriptors:** euthanasia, veterinary medicine, ethics, animals.

**Language of Text:** Portuguese, Summary in English.


**Descriptors:** animal welfare, laboratory animals, carbon dioxide poisoning, veterinary euthanasia, United States Public Health Service, veterinary medicine standards.

ANIMAL EUTHANASIA

Descriptors: animal disease transmission, animal welfare legislation, euthanasia, domestic animals, guidelines, public policy, United States.


Descriptors: end-of-life conversations, veterinary practices, ethics, SPIKES six-step model, euthanasia decision making.


Descriptors: animal welfare, euthanasia, therapy.

Language of Text: German, Summary in English.


Descriptors: carbon monoxide, carbon dioxide, hydrogen cyanide, inhaled anesthetics, nitrogen, injectable anesthetics, barbiturates, chloral hydrate, ethanol, euthanizing agents.


Descriptors: euthanasia, veterinary medicine, professional ethics and manner, treatment and therapy, dogs, cats, pets.


Descriptors: anesthesia, analgesics, animal welfare, euthanasia, laboratory animals, preanesthetic, dogs.


Descriptors: euthanasia, veterinary technicians, textbook.


Descriptors: drug delivery systems, euthanasia, pain, animals.

Language of Text: Turkish, Summary in English.

Descriptors: zoos, wildlife parks, euthanasia as management tool, ethics, care in captivity, United Kingdom.

Descriptors: euthanasia, animal ethics, veterinary legislation, domestic animals, laboratory animals, wild animals, zoo animals, Netherlands.
Language of Text: Dutch.

NAL Call Number: QL77.5.W45 1996
Descriptors: zoos, wildlife parks, animal well-being, managerial euthanasia, animal welfare.
Notes: Available from SCAW, 7833, Walker Drive, Suite 340, Greenbelt, MD 20770. Tel: 301-345-3500.

Descriptors: human-pet bonding, animal shelters, occupational hazard, emotional stress.

Descriptors: animals, antineoplastic agents, animal welfare, euthanasia.
Language of Text: Dutch.

Descriptors: euthanasia, anesthesia, animal welfare, carbon dioxide.

Descriptors: euthanasia, veterinary medicine, ethics.
Language of Text: Turkish, Summary in English.
Livestock


Online: http://www.aasp.org/aasv/euthanasia.pdf

NAL Call Number: HV4731.O5 2001

Abstract: Good information on euthanasia of swine with tables on Appropriateness of various methods and Specific euthanasia methods for swine with diagrams for blunt trauma, captive bolt, gun shot and electrocution.

Descriptors: Internet resource, euthanasia, swine, methods, appropriateness, pain, distress.


NAL Call Number: SF951.E62

Descriptors: horses, destruction of animals, grieving, emotions.


Descriptors: animal welfare, euthanasia of livestock, firearms, guidelines.

Language of Text: Norwegian, Summary in English.


Descriptors: euthanasia, injectable anesthetics, drug residue detection, horses, T-61, embutramide.

Language of Text: Dutch.


Descriptors: euthanasia, horses, wounds, gunshot, animal welfare, catheterization, skull.


Descriptors: abattoirs, animal welfare, euthanasia, legislation, slaughterhouses, veterinary medicine.

Language of Text: Swedish.


Descriptors: exotic pigs, euthanasia, swine, pot bellied pigs.
Descriptors: euthanasia, piglets, carbon dioxide, swine, pentobarbital, animal welfare, discomfort, comparison.
Language of Text: Dutch, Summary in English.

Descriptors: beef cattle, intravenous injection, pentobarbital, euthanasia, xylazine, heart diseases, animal welfare, dosage, injectable anesthetics, analgesics, cardiac arrest.
Language of Text: Swedish, Summary in English.

Descriptors: euthanasia, slaughter, cattle.
Language of Text: French.

Descriptors: consumer product safety, euthanasia, legislation, cattle, emergencies, Great Britain.

Descriptors: euthanasia, cattle, veterinary medicine.

Descriptors: consumer product safety legislation, euthanasia, cattle, emergencies, veterinary medicine, Great Britain.

Descriptors: captive bolt, stunning, carbon dioxide, electronarcosis, euthanasia, piglets, slaughtering equipment, trauma, pigs, cranial trauma.
Language of Text: Spanish, Summary in English.

Choiniere, M. (2005). **Method of euthanasia in food animals must be practical and safe.** *The Canadian Veterinary Journal* 46(2): 105; Author Reply 106. ISSN: 0008-5286.

**Descriptors:** euthanasia, animal ethics, animal welfare, Canada, cost benefit analysis, safety, swine.


**Descriptors:** anesthetics, animal welfare, euthanasia, slaughter, horses.

**Language of Text:** German.


**Descriptors:** disease outbreaks, euthanasia, foot and mouth disease, meat standards, animal welfare, consumer product safety.

**Language of Text:** Dutch.


**Descriptors:** euthanasia, animal welfare, horses.


**Descriptors:** euthanasia, horses, human behavior, veterinary services, equine, owner support.


**Abstract:** OBJECTIVE: To compare the brain damage in sheep resulting from penetrating and non-penetrating captive bolt stunning. DESIGN: The unrestrained heads of anaesthetised lambs were impacted in the temporal region with penetrating and non-penetrating captive bolt pistols (humane stunners) using a constant charge. Two hours after head impact, brains were perfusion-fixed with 4% paraformaldehyde. Coronal sections were stained with haematoxylin and eosin and immunohistochemically for amyloid precursor protein, a sensitive marker of axonal and neuronal reaction in brains after trauma. Pathological changes in these brains were then quantified by morphometric analysis. RESULTS: The skull was fractured in 50%
of lambs after a non-penetrating head impact and in all animals after a penetrating head wound. Impact contusions were present in 80% of lambs receiving a non-penetrating head injury and in all of those with a penetrating wound. Total contusion area was similar in both groups. Amyloid precursor protein-positive axons and neurons, and haemorrhage, were widely distributed in the brain after both head impact types, but there was no statistically significant difference between the two groups. Multifocal necrosis of the cerebellar granular layer was found in all lambs with non-penetrating head injury, but in none with a penetrating injury. CONCLUSIONS: The structural brain damage, a mixture of focal and diffuse injury, produced by penetrating and non-penetrating captive bolt pistols was overall similar and of sufficient severity to suggest that both types of weapon are acceptable for euthanasia.

Descriptors: brain injuries, euthanasia, sheep injuries, gunshot wounds, animal welfare, euthanasia.


Abstract: OBJECTIVE: To determine the severity and distribution of structural changes in the brains of adult sheep stunned by penetrating captive bolt.

PROCEDURE: The unconstrained heads of ten, anaesthetised, unhorned, 2-year-old Merino sheep were impacted at the summit of the head with a penetrating captive bolt pistol. Six sheep were ventilated and four received no respiratory support. Two hours after impact, brains from the six ventilated sheep were perfusion-fixed with 4% paraformaldehyde. Sixteen whole, serial coronal sections from each brain were stained with haematoxylin and eosin and immunohistochemically for amyloid precursor protein, a sensitive marker of axonal and neuronal reaction in the brain after trauma. Pathological changes in these brains were then quantified by morphometric analysis. RESULTS: Structural change in all impacted brains was a mixture of focal injury around the wound track and more widely distributed damage in the cerebral hemispheres, cerebellum and brainstem, but varied considerably in severity between individual sheep. All nonventilated sheep died rapidly following respiratory arrest.

CONCLUSIONS: After penetrating captive bolt stunning, damage to the central reticular formation, axonal connections, and the cortical mantle is the likely reason for failure of respiratory control and traumatic loss of consciousness.

Descriptors: brain injuries, sheep, captive bolt, stunning, euthanasia, gunshot wounds, trauma severity indices.


Descriptors: cattle, euthanasia, animal welfare, practical, humane, methods.


NAL Call Number: SF961.A5

Descriptors: cattle, euthanasia, humane, practical.
Notes: Conference Information: Meeting held on Sept. 18-21, 1997, Montreal, Quebec, Canada.

NAL Call Number: SF605.N672
Descriptors: cattle, euthanasia methods, animal welfare, bovine, cattle.

Online: http://www.nal.usda.gov/awic/newsletters/v9n1/9n1grand.htm
Descriptors: cattle, swine, lameness, body condition, animal transport, euthanasia, slaughter, animal welfare.

Descriptors: abattoirs, slaughterhouses, ethics, euthanasia, pain, cattle, firearms, swine.
Language of Text: Dutch.

Herbert, W.J. (1996). Chemical euthanasia of horses. [Correspondence]. Veterinary Record 139(4): 100. ISSN: 0042-4900.
Descriptors: horses, destruction of animals, magnesium, sulphates, euthanasia, horses.

Descriptors: Veterinary-euthanasia, Potbellied-pig.

Descriptors: adjuvants, anesthesia, anesthetics, chloral hydrate, dibucaine administration, euthanasia, firearms, horses, secobarbital administration, cellulose administration, injections, intravenous.

Descriptors: dairy cows, downer animals, medical history, disease diagnosis, nonsteroidal anti inflammatory agents, animal welfare, euthanasia.

Descriptors: euthanasia, horses, neuromuscular depolarizing agents, succinylcholine,
muscle relaxants.


Descriptors: animal welfare, euthanasia, horses, barbiturates, dehydration, veterinary medicine.

Online: http://www.aaep.org
Descriptors: equine slaughter legislation, carcass disposal, euthanasia methods, horses, equine.

Descriptors: animal welfare, euthanasia, law and legislation, horses, professional ethics.
Language of Text: German, Summary in English.

Descriptors: pigs, euthanasia, humane, pentobarbital, horses, small animals, stress free.
Language of Text: German, Summary in English.

Descriptors: destruction of animals, horses, livestock insurance, agricultural insurance, euthanasia.

Descriptors: euthanasia of horses, detomidine, codeine, barbiturates, injectable anesthetics, case reports.

NAL Call Number: SF605.N672
Descriptors: destruction of animals, horses, euthanasia, veterinary profession.
Notes: Meeting Information: Meeting held on Jan. 14-18, 1995 in Orlando, Florida.

Descriptors: animal euthanasia, azaperone, carbon dioxide, hypnotics, sedatives, intramuscular injections, pentobarbital administration, swine.


Descriptors: swine, euthanasia, carbon dioxide, biosecurity.


Descriptors: anesthetics, animal welfare, euthanasia, hypoxia, pain physiology, stunning.

Notes: Available from AAZV.


Descriptors: horses, euthanasia, trajectories, brain, skull, gunfire and bomb damage.


Descriptors: animal welfare, cattle, animal euthanasia, consumer product safety.


Descriptors: euthanasia, animal, firearms, swine, animal welfare.


Descriptors: anesthesia, anesthetics, analgesics, antiinflammatory agents, euthanasia, feral pigs, wild pigs, pigs, Suidae, Tayassuidae.

Notes: Available from AAZV.


Descriptors: animal welfare, costs, economic analysis, euthanasia, pigs, compromised pigs.

Language of Text: Spanish.

Descriptors: domestic animals, cattle diseases, disease outbreaks, bovine spongiform encephalopathy, euthanasia, veterinarians, cattle, France, legislation.

Language of Text: French.


Descriptors: euthanasia methods, livestock, animal welfare.


Descriptors: animal welfare, euthanasia, animal ethics, Canada, pentobarbital administration and dosage, swine.

Notes: Comment In: Can Vet J. 2005 Feb;46(2):105; author reply 106.


Descriptors: animal disease transmission, animal welfare legislation, euthanasia, domestic animals, guidelines, public policy, United States.


Descriptors: abattoirs, animal welfare, euthanasia, United States Department of Agriculture, cattle, sheep, swine.


Descriptors: cattle, euthanasia methods, indications, considerations.


Descriptors: slaughter, animal welfare, legislation, euthanasia of animals, stunning, horses, animal care.

Language of Text: German, Summary in English.


Descriptors: euthanasia, method, injection, captive bolt, horse, quick, pain, stress.

Language of Text: German.
ANIMAL EUTHANASIA

Descriptors: cattle diseases, euthanasia, cattle, veterinary emergencies, legislation, Scotland, veterinary medicine.

Descriptors: cattle, veterinary emergencies, animal euthanasia methods, legislation, Great Britain, letter.

Descriptors: dairy cows, mortality, cattle diseases, risk assessment, dairy breeds, animal age, euthanasia, lactation, Netherlands, cause of death.

Descriptors: euthanasia, pig farming, pigs, methods.
Language of Text: Greek, Summary in English.

Descriptors: guidance notes, humane killing, balistics, correct shooting positions, carcass disposal, euthanasia technique, diagrams.

Descriptors: pamphlet, horse owners, methods of euthanasia, carcass disposal, horses.

Descriptors: abattoirs, euthanasia, hemorrhage, phlebotomy, captive bolt.
Language of Text: Dutch.

Abstract: The special problem of handling weak, chronically ill, injured farm animals or those not sellable for slaughter is described. Farmers generally do not have sufficient knowledge in killing animals. They need external help or they must take specific training courses to get the necessary knowledge. Solutions how to improve animal welfare in this field are given.

Descriptors: animal diseases, animal husbandry, animal welfare, domestic animals, euthanasia, Germany.

Language of Text: German.


Descriptors: swine, pigs, humane euthanasia, pentobarbital, horses, small animals, study, healthy, sick, saline solution.


Descriptors: animal feed, barbiturates, euthanasia, food contamination, horses.
Reptiles


Descriptors: animal welfare, euthanasia, guidelines, methodology, regulations, wild animals, amphibians.

Notes: Available from AAZV.


Descriptors: animal welfare, euthanasia, methodology, regulations, wild animals, reptiles.

Notes: Available from AAZV.


Descriptors: reptiles, euthanasia techniques, humane methods.


Descriptors: amphibians, reptiles, literature review, euthanasia methods.

Language of Text: Dutch, Summary in English.


Descriptors: fish, amphibians, reptiles, killing techniques, euthanasia methods.


Descriptors: animal welfare, techniques, rabbits, reptiles, rodents, humane euthanasia.

Language of Text: German, Summary in English.


Descriptors: animal welfare, euthanasia, guinea pigs, mice, rabbits, rats, reptiles.

Language of Text: Hungarian.


Rodents and Rabbits


Descriptors: animal welfare, euthanasia, small laboratory animals, medulla oblongata, rats, air injection, intramedullary.


Descriptors: mice, experimental design, leukemia, animal models, animal welfare, posture, animal behavior, mortality, euthanasia, animal husbandry, animal use alternatives, animal use refinement, laboratory mammals.


Abstract: The ACLAM Task Force on Rodent Euthanasia was appointed by President Lynn Anderson in 2002 in response to growing concerns and controversy regarding techniques that were commonly used for rodent euthanasia. Three issues were targeted as the focus of the report: euthanasia of fetal and neonatal rodents, the use of carbon dioxide for rodent euthanasia, and the impact of euthanasia techniques on data. The charge to the Task Force was to create a document that summarized in a scholarly and comprehensive manner all available data-based literature relevant to these topics, to assess the scientific merit of the design and conclusions of those studies, and to compile valid information into a concise and cohesive document that could serve as a resource for diplomates, other veterinarians, IACUC members, regulatory bodies, and research scientists. The Task Force has fulfilled this charge in an exemplary manner. During 2004-2005, the ACLAM officers and Board of Directors (BOD) reviewed and critiqued 2 draft versions of the report, and suggestions for change were incorporated into the document presented here. In July 2005, the BOD voted to forego the usual process of distributing the document to theACLAM membership for comment before release based on 2 considerations. First, the literature relevant to rodent euthanasia is continually expanding. As such, at each revision, the Task Force was compelled to incorporate new data and citations. Their consensus view was that new data would continue to emerge, and the document would require continual revision as the review process continued. Related to that, the 2nd consideration of the BOD was that information already accumulated would be of immediate utility to the stake-holders listed above. In lieu of a pre-publication comment period, the BOD and the Task Force instead invite all diplomates, as well as other parties, to comment via email or mail to the BOD liaison for this project, who will compile and maintain all remarks. After an interval deemed appropriate by the ACLAM President, a 2nd Task Force will
be appointed to update and modify the Report. Comments will be considered at that
time. I want to personally thank all members of the Task Force for their conscientious
and comprehensive efforts in compiling this information. They have created a
valuable and informative synthesis that should serve as a resource to the community
for years to come.

Descriptors: laboratory animals, euthanasia methods, laboratory animal science,
advisory committees, animal welfare, carbon dioxide toxicity, drug delivery systems,
psychological stress, rodents.

Descriptors: euthanasia, rats, liver metabolism, influence, method, optimal method,
impact on experimental data.

euthanasia: concerns regarding pain and distress, with special reference to mice
and rats. Laboratory Animals 39(2): 137-161. ISSN: 0023-6772.
Abstract: Carbon dioxide (CO2) is the most commonly used agent for euthanasia of
laboratory rodents, used on an estimated tens of millions of laboratory rodents per
year worldwide, yet there is a growing body of evidence indicating that exposure to
CO2 causes more than momentary pain and distress in these and other animals. We
reviewed the available literature on the use of CO2 for euthanasia (as well as
anaesthesia) and also informally canvassed laboratory animal personnel for their
opinions regarding this topic. Our review addresses key issues such as CO2 flow rate
and final concentration, presence of oxygen, and prefilled chambers (the animal is
added to the chamber once a predetermined concentration and flow rate have been
reached) versus gradual induction (the animal is put into an empty chamber and the
gas agent(s) is gradually introduced at a fixed rate). Internationally, animal research
standards specify that any procedure that would cause pain or distress in humans
should be assumed to do so in non-human animals as well (Public Health Service
and Development 2000). European Union guidelines, however, specify a certain
threshold of pain or distress, such as 'skilled insertion of a hypodermic needle', as the
starting point at which regulation of the use of animals in experimental or other
scientific procedures begins (Biotechnology Regulatory Atlas n.d.). There is clear
evidence in the human literature that CO2 exposure is painful and distressful, while
the non-human literature is equivocal. However, the fact that a number of studies do
conclude that CO2 causes pain and distress in animals indicates a need for careful
reconsideration of its use. Finally, this review offers recommendations for alternatives
to the use of CO2 as a euthanasia agent.
Descriptors: animal welfare, laboratory animals, carbon dioxide, euthanasia methods,
laboratory animal science, carbon dioxide, dose response relationship, mice, rats.

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.
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%.

Descriptors: rats, laboratory animals, carbon dioxide, oxygen, anesthesia, euthanasia of animals, pain, animal welfare.

Descriptors: animal welfare, techniques, rabbits, reptiles, rodents, humane euthanasia.
Language of Text: German, Summary in English.

Descriptors: animal welfare, euthanasia, guinea pigs, mice, rabbits, rats, reptiles.
Language of Text: Hungarian.

Descriptors: golden hamsters, glucocorticoids, animal stress, litter (bedding).

**Abstract:** Carbon dioxide euthanasia is an established method for the termination of small laboratory animals. It has also been employed by the authors in neurobiological research on the postmortem glutamate concentration in the structures of rat brains. The following investigations were aimed at optimizing the termination procedure based on the CO2 saturation rate of the inhaled air. Two rates of CO2 flow were applied, and the higher one significantly augmented the glutamate level in the hippocampus and cerebellum. The relationship between this finding and signs of central fear reaction is discussed. The authors conclude that lower rather than higher CO2 flow in euthanasia procedures is gentler and is therefore preferable for use with laboratory animals.

**Descriptors:** rats, euthanasia, carbon dioxide, dosage, fearfulness, animal welfare, amygdala, hippocampus, cerebellum, glutamic acid, animal use refinement, fear reaction.


**Descriptors:** German Animal Welfare Act, euthanasia of vertebrates, available methods of euthanasia, small rodents, assessment of animal welfare, literature review.

**Language of Text:** German, Summary in English and German.


**Abstract:** A method of inducing euthanasia by carbon dioxide (CO2) inhalation in the home cage of an animal is described and tested for distress by behavioural as well as by hormonal measures. The animals were maintained in their home cage while CO2 was induced at a flow of 6 l/min. The behaviour of the animals was measured continuously as were the serum concentrations of glucose, ACTH and corticosterone 30, 75 and 120 s after the CO2 was introduced into the cage. In order to test for distress, two groups of rats were pre-treated with acepromazine (orally) and pentobarbiturate (i.p. injection) respectively, in order to reduce possible distress caused by CO2 euthanasia, and were compared with control groups. There were no signs of distress by behavioural or by hormonal changes. All changes seen could be attributed to experimental effects and, especially as there was no difference between the pre-treated and the control groups of rats, it must be assumed that the described method of euthanasia is in concordance with animal welfare, it leads to rapid death without severe distress or pain, and it seems therefore to be 'humane'.

**Descriptors:** animal welfare, carbon dioxide, euthanasia, anesthesia, sedatives, animal behavior, rats.

Descriptors: euthanasia, intraperitoneal injections, pain, rats.

Descriptors: anesthesia, analgesia, euthanasia, inhaled anesthetics, injectable anesthetics, small animal practice, chinchillas, gerbils, guineapigs, hamsters, mice, rabbits, rats, veterinary medicine.
Language of Text: German.

Abstract: Efficient production of transgenic mice requires high yields of viable, healthy embryos. Cervical dislocation (without prior anesthesia) rather than CO2 inhalation as a means of euthanasia has been justified on the basis of the increased yield of viable ova, but controlled studies have not directly supported this contention. The American Veterinary Medical Association (AVMA) and Canadian Council on Animal Care (CCAC) Guides, and respective Institutional Animal Care and Use Committees (IACUC) have supported the use of CO2 as a preferred, humane method. The study reported here was undertaken to determine the relative yields of viable embryos from mice euthanized either by inhalation of 100% CO2 or by cervical dislocation. Inbred and hybrid mouse strains, representative of common strains used in genetic engineering experimentation included C57BL/6, FVB/N, and B6SJLF1. There was no difference in the embryo yields in comparisons using the two methods of euthanasia (P = 0.534). Decisions regarding the method of euthanasia can be made on the basis of criteria other than those associated with embryo yield and viability.
Descriptors: carbon dioxide, embryo physiology, euthanasia, spinal injuries, animal welfare, cell culture techniques, animal ethics, laboratory animal science, mice, inbred C57BL, transgenic mice.

Descriptors: mice, euthanasia, CO2O2, CO2, comparison, animal welfare, stress.
Notes: Poster presentation originally presented at The Institute of Animal Technology Annual Congress, March 2005.

Descriptors: animal welfare, laboratory animals, carbon dioxide poisoning, euthanasia, rats.

**Abstract:** We sought to determine whether any of the common methods of euthanasia for adult rodents would lead to an acceptable death for fetuses or neonates. We wanted to identify a method that was rapid, free of signs of pain or distress, reliable, and minimally distressful to the person performing the procedure and that minimized the amount of handling required to perform the procedure. We evaluated six methods of euthanasia, with and without anesthesia, in three age groups of mice: gravid mice (E14-20) and neonatal pups (P1-P7 and P8-P14). Euthanasia methods included: halothane inhalation, carbon dioxide inhalation, intraperitoneal sodium pentobarbital, intravenous potassium chloride, and cervical dislocation with and without anesthesia. Noninvasive echocardiography was used to assess heartbeat during euthanasia. With cardiac arrest as the definition of death, no method of euthanasia killed fetal mice. Halothane inhalation (5% by vaporizer) was not an acceptable method of euthanasia for mice of the age groups tested. Intraperitoneal administration of sodium pentobarbital for euthanasia required a higher dose than the previously established dose, and there is a risk of reduced efficacy in pregnant animals due to potential intrauterine injection. Carbon dioxide asphyxiation was the most efficient method of euthanasia for neonatal mouse pups P1-14. For pregnant adult mice, intravenous potassium chloride under anesthesia, carbon dioxide asphyxiation, and cervical dislocation alone or under anesthesia were excellent methods of euthanasia. Copyright 2004 American Association for Laboratory Animal Science

**Descriptors:** laboratory animals, euthanasia, mice, newborn animals, carbon dioxide, echocardiography, halothane poisoning, chemically induced heart arrest, pentobarbital poisoning, potassium chloride poisoning, spinal injuries.


**Descriptors:** laboratory animals, euthanasia, carbon dioxide, rats.

**Language of Text:** German, Summary in English.


**Descriptors:** animal welfare, carbon dioxide poisoning, euthanasia, animal methods, laboratory animals, rats.


**Abstract:** Despite euthanasia being the most common of all procedures carried out on laboratory animals, the potential distress associated with gaseous agents has received little interest until recently, with growing concern over use of carbon dioxide as a
humane method of euthanasia. The distress associated with exposure to carbon
dioxide, argon, and carbon dioxide-argon mixtures was investigated in rats and mice
by measuring the degree of aversion on exposure to low, medium, and high
concentrations of these agents. Animals were exposed to the various concentrations in
a test chamber containing air or gas mixtures that they were able to enter and leave at
will. Aversion was assessed, using measurements of initial withdrawal time and total
dwelling time in the test chamber, as they were the most sensitive measurements of
aversion. Comparisons between euthanasia agent and control (air) treatments
indicated that concentrations of agents recommended for rapid and efficient induction
are associated with some degree of aversion. Carbon dioxide and the carbon dioxide-
argon mixtures were more aversive than was argon for rats and mice. These findings
suggest that induction with carbon dioxide either alone or in combination with argon
is likely to cause considerable distress before the loss of consciousness in rodents,
which is unacceptable considering that effective and more humane alternatives are
available.

Descriptors: rats, mice, euthanasia, hypoxia, carbon dioxide, argon, mixtures, animal
welfare, distress, animal use refinement, escape responses, laboratory mammals.

determine humane methods of anaesthesia and euthanasia. Animal Welfare
13(Suppl.): S77-S86. ISSN: 0962-7286.
Descriptors: anesthesia, laboratory animals, rats, mice, carbon dioxide, halothane,
general anesthetics, animal welfare, aversion, euthanasia.

Guidelines for Euthanasia of Nondomestic Animals, American Association of Zoo
Descriptors: euthanasia, guidelines, inhaled anesthetics, potassium chloride,
stunning, rabbits, rodents, CO2.
Notes: Available from AAZV.

(CO2) for the euthanasia of rodents. Journal of the American Association for
Laboratory Animal Science JAALAS 45(4): 7. ISSN: 1559-6109.
Descriptors: laboratory animals, carbon dioxide toxicity, euthanasia, animal methods,
rodents.

euthanasia in an individually ventilated caging system: System development and
assessment. Journal of the American Association for Laboratory Animal Science
46(2): 65-73. ISSN: 1559-6109.
Descriptors: mice, euthanasia, automation, animal housing, cages, ventilation
systems, systems analysis, carbon dioxide, animal stress, distress.

Abstract: In biomedical research using animal models, the phrase "humane
endpoints" refers to predetermined criteria used to judge when the research animals should be humanely euthanized. The intended goal of humane endpoints is to minimize the distress or suffering of research animals; however, if applied incorrectly, this well-intended concept could lead to premature decisions and inaccurate data, resulting in a waste of animal life. A consensus on specific endpoints for shock and inflammation research is not available but several biochemical, physical and behavioral parameters have been suggested for other research models. In addition, the authors have found, in the studies presented here, that increasing body weight, decreased body temperature, and inability to ambulate are important parameters in a model of cecal ligation and puncture. However, it is clear that the applicability of these endpoints may change with the model of disease, intensity of insults, experimental treatments and other factors. Consequently, humane endpoints should be assigned cautiously and preferably after preliminary studies to prevent aberrant research results. In order to accomplish this, investigators must become aware of certain concepts including: when to implement endpoints, what endpoints to consider, and how to establish the endpoints for their studies. Equipped with the basic principles of humane endpoints, investigators can make informed decisions that meet current standards of animal care while still achieving the scientific goals of their research studies.

Descriptors: research design, sepsis, shock, animal welfare, laboratory animals, body temperature, disease models, euthanasia, mice, rats, research.


Descriptors: rats, laboratory animals, euthanasia, carbon dioxide, argon, hypoxia, distress, physical activity, vocalization, escape behavior, animal well being.


Descriptors: insects, habitat succession, euthanized mammalian carcasses, New York, decomposition of carcasses.


Abstract: Background and Purpose: The major goal was to determine whether variations in the method of CO2 euthanasia would induce significant immunologic differences. Methods: Young adult C57BL/6 mice (n = 40) were euthanized, using four regimens: 70% CO2/30% O2; 70% CO2/30% O2 leads to 100% CO2; 100% CO2-naive chamber; and 100% CO2 pre-charged chamber. Time to recumbency and euthanasia and body, liver, lung, spleen, and thymus masses were determined. Blood and spleen were further evaluated for leukocyte, lymphocyte, and thrombocyte counts,
erythrocyte characteristics, distribution of lymphocyte subpopulations, spontaneous and mitogen-induced blastogenesis, complement activity, and cytokine production. Results: Time to euthanasia was five- to eightfold longer in mice exposed to 70% CO2/30% O2 than that for any other group. There were slight increases in mean erythrocyte volume (MCV) and mean erythrocyte hemoglobin (MCH) for all groups, compared with those for the 100% CO2 pre-charged group. Circulating cytotoxic T (CD8(+)) lymphocyte percentages and numbers, and spontaneous blastogenesis of leukocytes in blood and spleen, also were affected by euthanasia method. Conclusions: The method of CO2 euthanasia can result in significant differences in immunologic/hematologic variables. Thus, consistency in euthanasia procedures may be important in accurate interpretation of research data.

Descriptors: mice, euthanasia, carbon dioxide, mixtures, oxygen, lymphocytes, spleen, lymphocyte proliferation, blood serum, blood plasma, transforming growth factors, interleukin-2, tumor necrosis factor, experimental design, animal welfare, distress, hematologic tests, leukocyte count, complement activation.

Persinger, M.A. (2003). Rats' preferences for an analgesic compared to water: An alternative to "killing the rat so it does not suffer". Perceptual and Motor Skills 96(2): 674-680. ISSN: 0031-5125.

Abstract: A common policy in research institutions is to kill rats when they display chronic disabilities or recurrent injuries. These guidelines appear to be derived from an oxymoron that "it's better for a rat to be killed so it does not suffer pain" and from untested assumptions that rats cannot control "pain." In a two-bottle paradigm, 10 rats with a history of brain damage following status epilepticus from a single systemic injection of lithium and pilocarpine were given options to consume freely either tap water or 1 mg/cc of acetaminophen in tap water. During periods of fresh lesions due to persistent gnawing or acute injuries associated with tonic-clonic convulsions, the rats consumed 3 to 10 times the fluid from the bottles containing acetaminophen (equivalent to 5 to 10 extra-strength Tylenol tablets per day for a 70-kg person) relative to periods when no lesions or old lesions were present. These results suggest that rats with chronic injuries sufficient to be terminated according to Animal Care guidelines may be capable of reducing the aversive physiological conditions associated with tissue damage by selecting analgesic treatments.

Descriptors: analgesics administration and dosage, choice behavior, euthanasia, pain prevention and control, water, rats.


Abstract: Exposure to carbon dioxide (CO2) is the most prevalent method used to euthanize rodents in biomedical research. The purpose of this study was to determine the time of CO2 exposure required to euthanize neonatal mice (0 to 10 days old). Multiple groups of mice were exposed to 100% CO2 for time periods between 5 and 60 min. Mice were placed in room air for 10 or 20 min after CO2 exposure, to allow for the chance of recovery. If mice recovered at one time point, a longer exposure was examined. Inbred and outbred mice were compared. Results of the study indicated that
time to death varied with the age of the animals and could be as long as 50 min on the
day of birth and differed between inbred and outbred mice. Institutions euthanizing
neonatal mice with CO2 may wish to adjust their CO2 exposure time periods
according to the age of the mice and their genetic background.

Descriptors: inhalation anesthesia, animal welfare, carbon dioxide administration,
euthanasia, age factors, newborn animals, mice, species specificity.

nitrogen for inducing unconsciousness or euthanasia of rats. Journal of the
American Association for Laboratory Animal Science 45(2): 21-25. ISSN: 1559-6109.

Abstract: We compared CO(2), Ar, and N(2) for inducing unconsciousness and
euthanasia of Sprague-Dawley rats. We determined time to unconsciousness and
monitored heart rate (HR) and mean arterial blood pressure (MAP) by radiotelemetry
to assess stress, recovery after exposure, and time of death. Unconsciousness (mean
+/- standard error) occurred 24 +/- 3, 87 +/- 8, and 93 +/- 8 s after short-term exposure
to CO(2), Ar, and N(2), respectively. During exposure, CO(2) depressed HR, whereas
Ar and N(2) increased HR. Upon removal from the chamber, rats' HR rapidly
normalized after CO(2) or N(2) but remained elevated for 60 min after Ar. During
exposure, all agents depressed MAP, which returned to resting levels 10 to 50 min
after rats' removal from the chamber. For euthanasia, CO(2) at approximately 100%
induced unconsciousness in 37 +/- 3 s, increased and then depressed MAP and HR,
and caused death at 188 +/- 15 s. CO(2) at approximately 30% induced
unconsciousness in 150 +/- 15 s, decreased HR and MAP, and induced death at 440
 +/- 9 s. Ar at approximately 100% increased MAP but decreased HR, induced
unconsciousness with hyperreflexia at 54 +/- 4 s, and caused death at 197 +/- 20 s.
N(2) at approximately 100% decreased MAP but not HR and produced
unconsciousness with hyperreflexia at 164 +/- 17 s and death at 426 +/- 28 s. We
conclude that CO(2) effectively produced unconsciousness and euthanasia, but we
were unable to ascertain distress. Ar also appears effective but produced hyperreflexia
and tachycardia. N(2) was ineffective.

Descriptors: laboratory animals, argon, carbon dioxide, euthanasia methods, nitrogen,
chemically induced unconsciousness, blood pressure, heart rate, Sprague Dawley rats,
reflex, abnormal drug effects.

euthanasia using carbon dioxide gas. Laboratory Animals 31(4): 337-346. ISSN:
0023-6772.

Descriptors: rats, behavior, animal welfare, carbon dioxide, destruction of animals,
laboratory animals.

Effect of method of euthanasia on sperm motility of mature Sprague-Dawley
rats. Journal of the American Association for Laboratory Animal Science JAALAS
46(2): 13-20. ISSN: 1559-6109.

Descriptors: rats, euthanasia, methodology, carbon dioxide, anesthetics, decapitation,
spermatozoa, sperm motility, volatile anesthetics.
Descriptors: animal welfare, laboratory animals, carbon dioxide toxicity, escape reaction, euthanasia, research design, animal ethics, mice, rats, reproducibility of results.

Online: www.iat.org.uk
Descriptors: rat, euthanasia, halothane, oxygen-carbon dioxide mixture, delivery rates, discomfort.
Wildlife: Captive and Free-ranging


NAL Call Number: SF756.394 .G84 2006

Abstract: "This document represents an attempt by the professional zoological and wildlife community to gather and publish the best-known procedures for euthanatizing the animals they manage. Although guidelines for euthanasia have been published previously, the present effort provides the beginning of an ongoing quest for procedures that mitigate pain and distress and provide for a humane termination of life for species other than those commonly defined as domestic animals."--Introduction.

Descriptors: euthanasia of animals, handbooks, manuals, zoo animals, management.

Notes: Available from AAZV.


Descriptors: large animals, hippos, rhinos, elephants, anesthesia, anesthetics, animal welfare, euthanasia, restraint of animals.

Notes: Available from AAZV.


Descriptors: minks, foxes, fur bearing animals, destruction of animals, animal welfare.


Descriptors: anesthesia, butorphanol, diazepam, euthanasia, flunixin, ketamine, ketoprofen, pentobarbital, xylazine, nonhuman primates.

Language of Text: French.


Descriptors: nonhuman primates, anesthesia, analgesia, euthanasia, aspects, practices.

Language of Text: French.

Descriptors: carbon dioxide, euthanasia, animal welfare, mink, animal behavior, detection of CO2, humane euthanasia.

Descriptors: small animal practice, animal injuries, animal handling, euthanasia, human wildlife relations, animal law, wildlife rehabilitation, United Kingdom.

Descriptors: animal welfare, drugs, euthanasia, guidelines, licences, wild animals.
Notes: Available from AAZV.

Descriptors: animal welfare, euthanasia, overcrowding, zoo animals, aged animals.
Language of Text: German, Summary in English.

Descriptors: disease reservoirs, Mustelidae, tuberculosis, disease prevention and control, cattle, England, euthanasia, veterinary medicine.

Descriptors: anesthesia, anesthetics, carbon dioxide, carbon monoxide, decapitation, euthanasia, guidelines, xylazine, zoonoses, Chiroptera, bats.
Notes: Available from AAZV.

Descriptors: anesthetics, animal welfare, euthanasia, hypoxia, pain physiology, stunning.
Notes: Available from AAZV.

Descriptors: hoofstock, ungulates, anesthesia, analgesics, animal welfare, euthanasia.
Notes: Available from AAZV.

Descriptors: animal welfare, aquatic invertebrates, euthanasia methods, invertebrates.

Notes: Available from AAZV.


Descriptors: adjuvants, anesthesia poisoning, euthanasia, pentobarbital poisoning, raptors, wild animals.


Descriptors: marsupials, kangaroos, wallabies, anesthesia, euthanasia, restraint of animals, Acrobatidae, Dasyuridae, Dasyuridae, Dasyuridae, Macropodidae, marsupials, Peramelidae, Phascolarctos, Tarsipes, Vombatus.

Notes: Available from AAZV.


Descriptors: hedgehogs, anesthesia, euthanasia, Monotremata, Platypus, Tachyglossidae.

Notes: Available from AAZV.


Descriptors: effects of hypoxia, euthanasia, carbon dioxide, argon, animal welfare, animal behavior, mink.


Descriptors: nonhuman primates, laboratory animals, animal use refinement, animal well being, animal welfare, animal stress, distress, pain, restraint of animals, blood sampling, surgery, postoperative care, analgesia, humane endpoints, euthanasia.


Descriptors: Odocoileus virginianus, culling, sedation, urban habitats, immobilization, euthanasia methods, management implications, South Carolina.


**Abstract:** Seventeen recently trapped opossum, *Didelphis virginiana*, (median weight 2.45 kg; range = 1.6-5.0 kg; quartiles = 1.8-3.3 kg) were immobilized with either telazol (15 or 30 mg/kg) or a mixture of medetomidine (100 micrograms/kg), butorphanol (0.2 mg/kg), and ketamine HCl (10 mg/kg) based on estimated weights. Anesthetized animals were subjected to cardiac puncture for blood withdrawal and toe pinch. Euthanasia was accomplished by intracardiac administration of 1 ml of concentrated pentobarbital sodium/phenytoin solution. Weights were underestimated for 14 of 17 animals, but were within 0.5 kg of the actual weight. Both drug combinations provided rapid and calm immobilization. Median time to recumbency for the medetomidine-butorphanol-ketamine group (n = 5) was 6 min (range = 4-10 min; quartiles = 6 and 8 min). The median time to recumbency was not statistically different for the low (n = 6) and high dose (n = 6) telazol groups, 3 and 3.5 min respectively (quartiles 3; 3.5 and 4; 5.5 min). The stronger heart beat with telazol immobilization facilitated cardiac puncture. All five animals administered the medetomidine-butorphanol-ketamine mixture and three of six animals given the low telazol dose reacted to cardiac puncture. Only one of six animals given the estimated 30 mg/kg dose of telazol reacted slightly to cardiac puncture. We conclude that 30 mg/kg telazol provides sufficient immobilization and analgesia to allow accurate cardiac puncture of the opossum if the procedure is performed within 5 to 10 min of recumbency. Intracardiac administration of concentrated pentobarbital sodium/phenytoin solution followed by bilateral thoracotomy provides appropriate euthanasia suitable for field situations.

**Descriptors:** euthanasia, immobilization, opossums, analgesics, anesthetics, animal welfare, butorphanol, drug combinations, hypnotics and sedatives, imidazoles, ketamine, medetomidine, muscle relaxants, pentobarbital, phenytoin, tiletamine, zolazepam.


**Descriptors:** anesthesia, anesthetics, barbiturates, euthanasia, potassium chloride, nonhuman primates, monkeys.

**Notes:** Available from AAZV.

Descriptors: animal welfare, euthanasia, pain, regulations, training, wild animals, zoo animals.
Notes: Available from AAZV.
Index

abattoirs, 31, 35, 38, 39
abdominal muscles, 1
abnormal behavior, 11, 12, 21
abnormal drug effects, 52
acceptable methods of euthanasia, 21
acepromazine, 12, 46
Acrobates, 56
acrylics, 16
acute effects, 7
adjuvants, 35, 56
advisory committees, 44
age factors, 10, 52
age groups, 11, 48
aged animals, 55
aggression, 11, 12, 20
aging, 13
aging animals, 13
agricultural insurance, 36
agriculture methods, 7
air injection, 15, 43
air temperature, 16
alternative medicine, 27
aluminum, 16
American lobsters, 1
amphibians, 2, 3, 41
amygdala, 46
analgesia, 14, 29, 42, 47, 54, 56, 57
analgesics, 1, 14, 29, 32, 37, 51, 55, 57
analgesics administration and dosage, 51
anesthesia, 3, 4, 6, 8, 14, 18, 22, 29, 30, 35, 37, 42, 44, 45, 46, 47, 48, 49, 54, 55, 56, 57
anesthesia poisoning, 56
anesthetics, 2, 33, 35, 37, 52, 54, 55, 57
animal, i, iii, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58
animal age, 39
animal behavior, 4, 5, 7, 10, 11, 15, 17, 20, 23, 43, 46, 55, 56
animal care, 2, 15, 16, 18, 19, 21, 38, 50
animal care committees, 15, 16, 18, 19, 21
animal disease transmission, 28, 38
animal diseases, 4, 21, 24, 40
animal distress, 4
animal ethics, 4, 5, 9, 15, 17, 18, 19, 21, 23, 30, 33, 38, 47, 53
animal euthanasia, 4, 8, 15, 16, 19, 23, 24, 25, 28, 37, 39, 43
animal euthanasia methods, 39
animal experiments, 17, 24
animal feed, 40
animal handling, 18, 55
animal hospitals, 12
animal housing, 49
animal husbandry, 40, 43
animal injuries, 10, 55
animal keepers, 2, 17
animal law, 9, 55
animal legislation and jurisprudence, 25
animal methods, 16, 48, 49
animal models, 43, 49
animal owners, 9, 13, 15
animal ownership, 9, 15
animal population control methods, 9
animal rescue shelters, 9, 26
animal rights, 27, 28
animal shelters, 9, 13, 21, 26, 30
animal stress, 45, 49, 56
animal technicians, 21, 27
animal transport, 35
animal use, 4, 15, 25, 43, 46, 49, 56
animal use alternatives, 43
animal use refinement, 15, 25, 43, 46, 49, 56
animal welfare, i, 2, 3, 4, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58
animal welfare ethics, 22, 27, 28
animal welfare legislation, 29, 38
animal welfare standards, 7, 28
animal well being, 50, 56
animals, iii, 2, 10, 12, 13, 15, 16, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 33, 34, 38, 39, 44, 45, 46, 48, 50, 52, 54, 55, 56, 57
animal well being, 50, 56
INDEX

animals used for scientific purposes, 26
anorexia, 11
antiinflammatory agents, 37
antineoplastic agents, 30
appropriateness, 31
aquaculture, 3
aquarium fishes, 3
aquatic invertebrates, 56
argon, 7, 49, 50, 52, 56
arterial blood pressure, 11, 52
aspects, 6, 20, 25, 30, 45, 48, 54
asphyxia veterinary, 7
assessment of animal welfare, 46
attitude of health personnel, 16, 20
attitudes, 10
authority, 27
automation, 49
available methods of euthanasia, 46
aversion, 7, 49, 54
avian influenza, 4, 6
azaperone, 37
Balanoptera physalus, 3
balistics, 39
barbiturates, 3, 29, 36, 40, 57
bats, 55
cattle, 32
behavior, 5, 10, 12, 13, 52
behavior problems, 10, 12, 13
behavioral problems, 12
bell jar, 16
bibliographies, 22
bioethical issues, 23
bioethics, 24, 27
biosecurity, 37
bird diseases, 8
birds, 4, 6, 7, 8
bites, 11
blood gases, 6
blood plasma, 51
blood pressure, 52
blood sampling, 56
blood serum, 51
body condition, 35
body temperature, 50
bovine, 34, 35, 38
bovine spongiform encephalopathy, 38
brain, 5, 22, 24, 33, 34, 37, 51
brain injuries, 34
breed differences, 24
breeding, 10, 13
broiler chickens, 4, 5, 7, 8
broilers, 4, 5, 7, 8
budgerigar, 8
butorphanol, 54, 57
cadaver processing, 18
cages, 49
Canada, 10, 28, 33, 35, 38
captive bolt, 31, 32, 33, 34, 35, 38, 39
captive bolt pistol, 33, 34, 35, 39
capture of animals, 3, 20
carbon dioxide, iii, 1, 3, 4, 5, 6, 7, 8, 15, 16, 20,
25, 28, 29, 30, 32, 37, 43, 44, 46, 47, 48,
49, 50, 51, 52, 53, 54, 55, 56, 57
carbon dioxide administration, 52
carbon dioxide metabolism, 16
carbon dioxide poisoning, 28, 47, 48
carbon dioxide toxicity, 44, 49, 53
carbon monoxide, 29, 55, 57
carcass disposal, 3, 8, 18, 25, 36, 39
cardiac arrest, 1, 32, 48
care in captivity, 2, 17, 26, 30
carnivores, 57
case report, 2, 17, 36
case reports, 36
castration, 9
catheterization, 31
cats, 9, 10, 12, 13, 14, 21, 22, 23, 24, 26, 28, 29
cattle, 32, 34, 35, 37, 38, 39, 55
cattle diseases, 38, 39
cause of death, 39
causes of death, 24
cell culture techniques, 47
cellulose administration, 35
ceramics, 16
cerebellum, 34, 46
cervical dislocations, 19, 21
cervical vertebrae injuries, 15, 16
cetacea, 1
cetaceans, 1, 2, 3
chelonians, 42
chemical concentration, 7
chemical methods, 24
chemically induced anoxia, 21
chemically induced heart arrest, 48
chemically induced unconsciousness, 52
chickens, 4, 5, 7, 8
child, 27
chinchillas, 47
Chiroptera, 55
chloral hydrate, 29, 35
choice behavior, 51
chronic disease, 17
client, 10, 23, 24, 31
CO₂, iii, 1, 5, 44, 45, 46, 47, 48, 49, 50, 51
ANIMAL EUTHANASIA

CO2 euthanasia, iii, 1, 46, 50
CO2O2, 47
codeine, 36
combination drug therapy, 12, 14
communication, 19, 22, 29
companion animals, 10, 12, 13, 20, 26
comparison, 12, 24, 32, 47
comparison of methods, 24
complement activation, 51
composting, 8
compromised pigs, 37
congestive heart failure, 11
consciousness, 4, 5, 6
consent, 13, 27
considerations, 31, 38, 43
consumer product safety, 32, 33, 37
consumer product safety legislation, 32
controlled atmosphere stunning, 7
controlled atmospheres, 4
cope, 23
coping with death, 10
correct shooting positions, 39
cost benefit analysis, 33
costs, 20, 37
costs and returns, 20
cough, 12
counseling, 13
cranial trauma, 32
criticism, 16
culling, 55, 56
customer relations, 10
dairy breeds, 39
dairy cows, 35, 39
Dasyuridae, 56
data collection, 10, 14, 20
defaughtness, 13, 28
deadth, iii, 4, 5, 12, 17, 20, 21, 22, 23, 24, 27, 38, 39, 45, 46, 48, 52
deadth and dying, 24
deadth certificates, 17
death of pet, 12
decapitation, 28, 52, 55, 57
decision making, 16, 17, 19, 20, 29
decline in rates of euthanasia, 14
decomposition of carcasses, 50
dehydration, 36
delivery rates, 53
Delphinus delphis, 2
Denmark, 11, 12
destruction of animals, 11, 22, 23, 31, 35, 36, 52, 54
detection of CO2, 55
detomidine, 36
development, 31, 49, 54
diagnostic techniques, 42
diagrams, 31, 39
diazepam, 54
dibucaine administration, 35
Didelphidae, 56
discomfort, 5, 32, 45, 53
disease diagnosis, 35
disease models, 50
disease outbreaks, 4, 6, 7, 8, 25, 33, 38
disease outbreaks prevention and control, 4
disease prevention and control, 55
disease reservoirs, 55
dislocations, 15, 16, 19
distress, iii, 5, 7, 10, 17, 23, 31, 42, 44, 45, 46, 48, 49, 50, 51, 52, 54, 56
dog breeds, 24
dog diseases, 13, 28
dogs, 9, 10, 11, 12, 13, 14, 16, 17, 20, 21, 22, 23, 24, 26, 27, 28, 29
dogs as pets, 11
dolphins, 3
domestic animals, 9, 20, 27, 28, 29, 30, 31, 38, 40, 54
dosage, 10, 12, 14, 32, 46
dose response relationship, 44
downer animals, 35
drowning, 16
drug combinations, 57
drug delivery systems, 29, 44
drug effects, 12, 14
drug residue detection, 31
drugs, 2, 10, 55
ducks, 5
duration, 20, 45
dyspnea, 11
echocardiography, 48
economic analysis, 37
education, 18
effects of hypoxia, 56
efficacy, 9, 15, 48
electrocardiography, 6
electrocution, 28, 31
electroencephalogram during drowning, 22
electroencephalograms, 4
electroencephalography, 6, 11
electronarcosis, 32
elephants, 54
embryo physiology, 47
embutramide, 31
emergencies, 20, 32
INDEX

emergency medical services, 9
emotional stress, 30
emotions, 10, 24, 31
employee reactions, 26
employment, 27
end-of-life conversations, 29
endpoints, 25, 49
England, 2, 10, 13, 17, 55
equine, 33, 36
equine slaughter legislation, 36
errors, 20
escape behavior, 50
escape reaction, 53
escape responses, 49
ethanol, 29
ethics, 2, 7, 12, 13, 16, 17, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 35
ethics committees, 23
etorphine, 1
euthanasia, i, iii, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58
euthanasia as management tool, 26, 30
euthanasia by drowning, 22
euthanasia decision making, 29
euthanasia documentation, 17
euthanasia guidelines, 17
euthanasia hazards, 24
euthanasia in zoos, 26
euthanasia method, 1, 2, 4, 8, 15, 19, 31, 33, 35, 36, 38, 41, 42, 44, 51, 52, 56
euthanasia methods, 1, 2, 15, 19, 31, 35, 36, 38, 41, 42, 44, 52, 56
euthanasia of animals, 7, 11, 15, 17, 18, 21, 26, 38, 45, 54
euthanasia of broilers, 5
euthanasia of horses, 35, 36, 40
euthanasia of livestock, 9, 31
euthanasia of pets, 10
euthanasia of pregnant animals, 21
euthanasia of vertebrates, 46
euthanasia statistics and numerical data, 10
euthanasia technique, 2, 3, 6, 16, 18, 22, 39, 42, 43
euthanasia techniques, 2, 3, 6, 16, 18, 22, 42, 43
euthanasia veterinary, 7, 16, 21
euthanized mammalian carcasses, 50
euthanizing agents, 29
euthanizing groups of animals, 5
euthanization because of behavior problems, 11
euthanization techniques, 41
evaluation, 23
exotic pigs, 31, 35, 37
experimental animals, 18, 21, 25
experimental design, 43, 51
explosives, 3
factors, 11, 23, 26, 50
Falkland Islands, 3
fear reaction, 46
fearfulness, 46
feeding behavior, 7
feral pigs, 37
fin whales, 3
firearms, 9, 31, 35, 37
fish, 2, 41
fishes, 1, 3
flunixin, 54
food contamination, 40
foot and mouth disease, 33
forms and records, 10
foxes, 54
France, 23, 25, 38
fur bearing animals, 54
gas mixtures, 5, 49
gas stunning, 7
gases, 7
gender differences, 24
general anesthetics, 25, 49
gerbils, 47
German Animal Welfare Act, 46
German Shepherd, 12
Germany, 13, 22, 40, 48
Globicephala melaena, 2
glucoerocorticoids, 45
glutamic acid, 46
goals and options, 6
golden hamsters, 45
gonadectomy, 13
Great Britain, 16, 17, 32, 39
greyhounds, 10, 13, 14
grief, 4, 25
grieving, 20, 31
guidance notes, 39
guidelines, iii, 9, 17, 28, 31, 36, 38, 41, 44, 49, 51, 54, 55
guinea pigs, 41, 45
guineapigs, 41, 45, 47
gunfire and bomb damage, 37
gunshot, 31, 34
gunshot wounds, 34
habitat succession, 50
halothane, 48, 49, 53, 57
halothane poisoning, 48
hamsters, 45, 47
handbooks, 54
health care costs, 28
healthy, 27, 33, 40, 47
heart beat, 22, 57
heart diseases, 32
heart rate, 1, 4, 52
hedgehogs, 56
hematologic tests, 51
hemorrhage, 39, 45
hippocampus, 46
hippos, 54
histocytochemistry temperature, 1
*Homarus americanus, 1*
hoofstock, 55
horse, 38, 39
horse owners, 39
horses, 22, 31, 33, 35, 36, 37, 38, 39, 40
housing, 5
HSUS, 26
psychological stress, 25
human behavior, 10, 24, 33
human health and safety, 15
human wildlife relations, 55
human-animal bond, 12
humane, iii, 10, 33, 34, 36, 38, 39, 40, 41, 43, 45, 46, 47, 49, 54, 55, 56, 57
humane endpoints, iii, 50, 56
humane euthanasia, iii, 36, 40, 41, 45, 55, 57
humane killing, 39
humane methods, 34, 41, 49
Humane Society of the United States, 26
human-pet bonding, 10, 20, 25, 30
husbandry, 3
hydrogen cyanide, 29
hygiene, 4
hypercapnia, 6
hypnotics, 21, 37, 57
hypnotics and sedatives, 21, 57
hypoxia, 5, 37, 49, 50, 55, 56
IACUCs, 15
illness, 10, 24
imidazoles, 57
immobilization, 3, 56, 57
impact on experimental data, 44
inbred C57BL, 47
indications, 38
infection control methods, 5
influence, 31, 44
influenza in birds, 4, 7
inhalation and injectable anesthetics, 28
inhalation anesthesia, 52
inhalation euthanasia, 8
inhalation exposure, 7
inhaled anesthetics, 3, 29, 47, 49
injectable anesthetics, 3, 29, 31, 32, 36, 47
injection, 1, 5, 15, 32, 38, 43, 46, 48, 51
injections, 35
injured wild birds, 6
insects, 50
interleukin-2, 51
Internet resource, 31
intramedullary, 15, 43
intramuscular injections, 37
intraperitoneal injections, 47
intravenous injection, 2, 32
intravenous, 35
invertebrates, 56
isoflurane, 57
Italy, 12
kangaroos, 56
ketamine, 14, 54, 57
ketoprofen, 54
killing rate, 5
killing techniques, 2, 41
labor, 26
laboratory, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 27, 28, 29, 30, 43, 44, 45, 46, 47, 48, 49, 50, 52, 53, 56
laboratory animal care, 18
laboratory animal science, 15, 16, 19, 21, 44, 47
laboratory animals, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 27, 28, 29, 30, 44, 45, 46, 47, 48, 49, 50, 52, 53, 56
laboratory equipment, 16
laboratory mammals, 43, 49
laboratory workers, 25
lactation, 39
lameness, 35
large animals, 16, 32, 54
law and legislation, 19, 36
legal aspects, 20
legislation, 6, 9, 12, 17, 19, 22, 25, 31, 32, 36, 38, 39
letter, 39
leukemia, 43
leukocyte count, 51
licences, 55
licensure, 10
lidocaine, 15
INDEX

literature overview, 3
literature review, 2, 27, 41, 46
literature reviews, 27
litter (bedding), 45
liver metabolism, 44
livestock, 18, 35, 36, 38
livestock insurance, 36
longevity, 24
loss of consciousness, 5, 34, 49
lymphocyte proliferation, 51
lymphocytes, 51
Macropodidae, 56
magnesium, 10, 16, 35
magnesium sulfate, 10, 16
management, 9, 11, 26, 29, 35, 39, 54, 56
management implications, 56
managerial euthanasia, 30
manuals, 54
marine mammals, 3
marsupials, 56
mass culling, 8
mass euthanasia, 5, 6
meat standards, 33
medetomidine, 57
medical ethics, 27, 28
medical history, 35
medulla oblongata, 15, 43
mepivacaine, 2
method, 1, 4, 7, 21, 31, 38, 44, 46, 47, 48, 49, 50, 51, 52, 56
method of slaughter, 7
methodology, 7, 41, 52
methods, 4, 6, 7, 18, 20, 21, 23, 31, 34, 39, 46, 47, 48
methods of euthanasia, 21, 39, 47, 48
methotrimeprazine, 1
mice, 41, 43, 44, 45, 47, 48, 49, 50, 51, 53
Michigan, 2, 9, 41
mink, 54, 56
minks, 54
mixtures, 4, 5, 16, 49, 51
monkeys, 57
Monotremata, 56
moral and ethical aspects of animal experimentation, 26
moral dilemma, 13
moral., 15
morbidity, 20, 25
mortality, 6, 20, 25, 36, 39, 43
muscle relaxants, 36, 57
Mustelidae, 55
necropsy, 42
Netherlands, 6, 15, 30, 39
neuroleptics, 12, 14
neuromuscular depolarizing agents, 35
New York, 50
newborn animals, 48, 52
Newcastle disease, 6
nitrogen, 4, 5, 7, 8, 29, 52
nonhuman primates, 54, 56, 57
nonsteroidal anti inflammatory agents, 35
occupational hazard, 20, 22, 30
occupational hazards, 20, 22
occupational health, 24, 27
Odocoileus virginianus, 56
old age, 10, 21
opossums, 57
optimal method, 44
oral administration, 12, 14
ornamental birds, 6
overcrowding, 55
owner grieving, 12
owner support, 33
owners, 11, 15
ownership, 10, 28
oxygen, 4, 44, 50, 51, 53
oxygen-carbon dioxide mixture, 53
pain, iii, 3, 10, 16, 17, 23, 24, 25, 29, 31, 32, 35, 37, 38, 44, 45, 46, 47, 48, 51, 54, 55, 56, 58
pain and distress assessment, 23
pain physiology, 37, 55
pain prevention and control, 25, 51
palliative care, 16, 24
pamphlet, 39
pedigree, 14
pentobarbital, 11, 15, 21, 32, 36, 37, 38, 40, 48, 50, 54, 56, 57
pentobarbital administration, 21, 37, 38
pentobarbital administration and dosage, 21, 38
pentobarbital poisoning, 48, 56
Peramelidae, 56
personality assessment, 10
personnel, 18, 21, 22, 44
personnel training, 18
pet animals, 11, 12, 13, 22
pet care, 24
pet owners, 20
pets, 10, 14, 21, 23, 24, 27, 29, 47
Phascolarctos, 56
phenytoin, 57
philosophy, 2
phlebotomy, 39
slaughter, 7, 22, 23, 32, 33, 35, 36, 37, 38, 39, 40
slaughterhouses, 31, 35
slaughtering equipment, 32
small animal euthanasia, 23
small animal practice, 13, 47, 55
small animals, 12, 20, 36, 40
small laboratory animals, 15, 28, 43, 46
small rodents, 46
snakes, 42
socioeconomic status, 21
South Carolina, 56
space research, 25
species differences, 20
species specificity, 52
specific heat, 16
sperm motility, 52
spermatozoa, 52
SPIKES six-step model, 29
spinal injuries, 47, 48
spleen, 50
Sprague Dawley rats, 45, 52
staff, 23, 26
statistical analysis, 20
stranded animals, 2
stress, 8, 10, 15, 21, 24, 25, 26, 36, 38, 47, 52
stress disorders, 27
stress free, 36
stress management, 25
students, 18, 23
study, 5, 9, 11, 12, 26, 40, 47, 51
stunning, 4, 7, 32, 33, 34, 37, 38, 49, 55, 57
succinylcholine, 35
suffering, 15, 24, 50
Suidae, 37
sulphates, 35
supply, 7, 21
surgery, 6, 56
survival analysis, 9, 20
suvey, 22
swine, 31, 32, 33, 35, 37, 38, 39, 40
systems analysis, 49
T-61, 11, 31
Tachyglossidae, 56
Tarsipes, 56
Tayassuidae, 37
team, 10
techniques, 1, 3, 6, 14, 18, 41, 42, 43, 45
terminal illness and injury, 24
textbook, 29
thanatology, 20
therapy, 25, 29, 30
thiopentone, 10
thorax, 7
tiletamine, 57
time to collapse, 11
toxicity testing, 1
training, 18, 24, 25, 26, 27, 40, 58
training manual, 26
training officers, 25
trajectories, 37
tranregenic mice, 47
transforming growth factors, 51
trauma, 31, 32, 33, 34
trauma severity indices, 34
treatment and therapy, 29
Treatment failure, 19
Treatment options, 13
treatment techniques, 6
tuberculosis, 55
tumor necrosis factor, 51
turkeys, 4, 5
turtles, 42
UK, 7, 14, 15, 20, 29, 39
ultrasonography, 1
unacceptable euthanasia technique, 22
ungulates, 55
unintentional outcome, 24
United Kingdom, 30, 55
United States, 18, 21, 26, 28, 29, 38
United States Department of Agriculture, 38
United States Public Health Service, 28
University of Bologna, 14
urban habitats, 56
urinary incontinence, 16
urination, 10
use of multiple euthanizing agents, 3
vaccination programs, 14
ventilation systems, 49
veterinarian, 11, 12, 13, 18, 25, 28, 33, 38
veterinarians, 10, 13, 14, 16, 19, 20, 23, 24, 26, 27, 28, 38, 43
veterinary drugs, 15
veterinary emergencies, 39
veterinary ethics, 19
veterinary guidance, 20
veterinary intervention, 6
veterinary jurisprudence, 20
veterinary legislation, 30
veterinary medicine, 6, 7, 10, 12, 13, 16, 17, 19, 20, 21, 23, 24, 25, 27, 28, 29, 30, 31, 32, 36, 39, 47, 55
veterinary medicine practice, 17
veterinary medicine standards, 28