

# **EUTHANASIA**

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## ***Introduction and definition***

- Many of the contents presented here are excerpts from **2000 Report of the AVMA Panel on Euthanasia (JAVMA 218 (5), 2001)**
- Euthanasia is a word of Greek origin, a rough translation being **Good death**
  - Webster English Dictionary  
The act or practice of *painlessly* putting to death death in hopelessly unwell or injured animals in a pain free manner on the grounds of humanity

## ***Criteria for evaluating methods of euthanasia***

- It must be painless and not induce fear or apprehension in the animal
- It must be reliable
- It must be rapid
- It must be safe and simple to operate
- It must be nonreversible
- It should be inexpensive
- It should as far as possible be aesthetic
- It should be possible to observe the animals at all times
- It should be safe for predators/consumers should the carcass be consumed

## ***Indications for euthanasia***

- Required as an experimental procedure
- Sustained a severe injury that is difficult to manage
- The animal is in excruciating pain refractory to the treatment
- On demand by the authority (State or Federal inspectors, IACUC etc.)
- The colony may be at risk by an infected individual
- On economic grounds
- Approved for a research project to terminate the life

## ***Methods of euthanasia***

- The methods can be divided into **physical** or **chemical** methods
- Physical methods
  - Stunning
  - Gun shot
  - Captive bolt
  - Electrocutation
  - Cervical dislocation
  - Decapitation

- Chemical methods
  - Drug injections
  - Gas or vapor inhalation
  - Some chemical methods are only *conditionally acceptable* and should not be used as sole method for euthanasia

## ***Selection/Application of euthanasia methods***

- Unacceptable as sole method
  - Exsanguinations
  - Air embolism
  - Drowning
- Unacceptable injectable agents as sole method
  - Strychnine
  - Nicotine
  - Caffeine
  - Magnesium sulfate
  - Potassium chloride
  - Cyanide
  - Cleaning agents
  - Solvents
  - Disinfectants
  - Other toxins or salts
  - All curariform agents (neuromuscular blocker agents)
- Acceptable as sole method
  - Inhalant anesthetic overdose
  - Injectable anesthetic overdose
- Conditionally acceptable
  - Hypoxic gas mixtures with high concentration that result in rapid loss of consciousness followed by cardiopulmonary arrest or use of such mixtures in animals already under general anesthesia
  - Injectables such as potassium chloride in animals already under general anesthesia

## ***Three basic mechanisms in terminating the life***

### **Hypoxemia, direct or indirect**

- CO<sub>2</sub>
- N<sub>2</sub>
- Argon
- CO

### **Direct depression of neurons vital for life function**

- Anesthetics
  - Injectables & Inhalants

### **Physical disruption of brain activity & destruction of neurons necessary for life**

- Stunning
- Gun shot
- Captive bolt
- Electrocutation
- Cervical dislocation
- Decapitation

## *Factors involved in the choice of euthanasia methods*

- Species
- Age
- Size
- Temperament
- Health status
- Number of individuals
- Availability of materials and apparatus
- Reason for euthanasia
- Fate of the carcass
- Personal preferences
- Technical proficiency
- Compliance to the regulatory authorities (approval may be needed for research projects)

## *Inhalant agents*

- Considerations
  - Speed of onset of loss of consciousness
  - Integrity of the equipment thoroughly checked prior to use
  - Hazard risk to the personnel
    - Explosion
    - Toxicity
    - Addiction
    - Hypoxemia
  - Noise
    - May frighten the animal

### **Inhalant anesthetic agents**

- Ether, halothane, enflurane, isoflurane, sevoflurane, desflurane, methoxyflurane and N<sub>2</sub>O
- Widely used across all species: reptiles, amphibians, and diving birds and mammals
- Advantages
  - Particularly valuable for smaller animals (< 7kg) or for animals in which venipuncture may be difficult
  - Halothane, enflurane, isoflurane, sevoflurane, desflurane, methoxyflurane and N<sub>2</sub>O are nonflammable and nonexplosive under ordinary environmental condition
- Disadvantages
  - Struggling and becoming anxious during induction of anesthesia
  - Ether and methoxyflurane may be unacceptably slow in inducing loss of consciousness in some species
  - Nitrous oxide will support combustion
  - Personnel and animals can be at risk by exposed to these agents
  - A potential human abuse
- Recommendations
  - Inhalant agents are acceptable for euthanasia of small animals (<7kg).
  - Nitrous oxide should not be used alone
    - Even at 100 % the animal is not anesthetized and therefore hypoxemia develops prior to cardiopulmonary arrest
  - Although acceptable, these agents are generally not used in larger animal because of their cost and difficulty of administration



- Induce loss of consciousness without pain and with minimal discernible discomfort
- Hypoxemia induced by CO is insidious so animal appears to be unaware
- Death occurs rapidly if concentrations of 4 to 6% are used
- Disadvantages
  - Safeguards must be taken to prevent exposure of personnel
  - Any electrical equipment exposed to CO (eg, lights and fans) must be explosion proof
- Recommendations
  - Personnel using CO must be instructed thoroughly in its use and must understand its hazards and limitations

- Recommendations
  - IV injection is preferred in dogs, cats, other small animals, and horses
  - Intraperitoneal injection may be used in situations when an intravenous injection is distressful or even dangerous
  - Intracardiac injection must only be used if the animal is heavily sedated, unconscious, or anesthetized

#### **Pentobarbital combinations**

- Several euthanasia products are formulated to include pentobarbital, usually added with local anesthetic agents
- These combinations are listed by the DEA as schedule III drugs, making them somewhat simpler to obtain, store, and administer than scheduled II drugs such as sodium pentobarbital

#### **Chloral hydrate**

- Depresses the cerebrum slowly
  - Restraint may be a problem for some animals
- Death is caused by hypoxemia resulting from progressive depression of the respiratory center
  - May be preceded by gasping, muscle spasms and vocalization
- Recommendations
  - Conditionally acceptable for euthanasia of large animals only when administered IV, and only after sedation to decrease the aforementioned side effects
  - Not acceptable for dogs, cats, & other small animals as the side effects may be severe

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## Cervical dislocation

- Used for many years, when performed by well-trained individuals, appears to be humane
- Used for many years for poultry, other small birds, mice, and immature rats and rabbits
- Advantages
  - Induce rapid loss of consciousness
  - Does not chemically contaminate tissue
  - Rapidly accomplished
- Disadvantages
  - Aesthetically displeasing
  - Requires mastery of the skills
  - Use is limited to poultry, small birds, mice and immature rats and rabbits

## Decapitation

- Used to euthanize rodents and small rabbits and research settings
- The tissues are chemically uncontaminated and brain tissues are intact
- Guillotines designed to accomplish decapitation in rodents and small rabbits are commercially available
- Advantage
  - Rapid loss of consciousness
  - Chemically not contaminate tissues
  - Rapidly accomplished
- Disadvantages
  - Handling and restraint required to perform this technique may be distressful to animals
  - Interpretation of the presence of electrical activity in the brain following decapitation has created controversy and its importance may still be open to debate
  - Personnel performing this technique should recognize the inherent danger of the guillotine and take adequate precautions to prevent personal injury
  - Decapitation may be aesthetically displeasing
- Recommendations
  - Conditionally acceptable if performed correctly and it should be used in research settings when its use is required by the experimental design and approved by the institutional animal care and use committee (IACUC)
  - Regular service to ensure sharpness of the blade
  - The use of plastic cones to restraining appears to reduce distress from handling, minimize the chance of injury to person, and improves positioning of the animal in the guillotine.
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## Electrocution

- Alternating current is used
- Induces death by cardiac fibrillation, which causes cerebral hypoxia.
- However, animal63 0c78

## Adjunctive methods

- Exsanguination
  - Can be used to ensure death subsequent to stunning or in otherwise unconscious animals because anxiety is associated with extreme hypovolemia
  - must not be used as a sole means of euthanasia
  - animals may be exsanguinated to obtain blood product but only when they are sedated, stunned, or anesthetized
- Stunning
  - Animals may be stunned by a blow to the head, by use of nonpenetrating captive bolt, or by use of electric current
  - Must be followed immediately by a method that ensures death
  - With stunning evaluation of unconsciousness is difficult but loss of menace, blinking, pupillary dilation, and the loss of coordinated movement can be useful
  - Specific changes in the EEG and a loss of visually evoked responses are also thought to indicate loss of consciousness
- Pithing
  - Generally used as an adjunctive procedure to ensure death in an animal that has been rendered unconscious by other means.
  - In some species such as frogs with anatomic features that facilitate easy access to the CNS pithing may be used as a sole means of euthanasia, but anesthetic overdose is a more suitable method

## *Post Euthanasia - Indicators of death*

- Check there is no heart beat
- Check there is no respiratory activity
- Check for signs of muscular rigidity (rigor mortis)
- Check for pupillary reflex of the eye
- Lack of blood pressure reading (particularly indicative by invasive monitoring)
- Change of skin configuration
- Involuntary urination or defecation