

# Update on the AVMA Guidelines for the Euthanasia of Animals: 2020 Edition

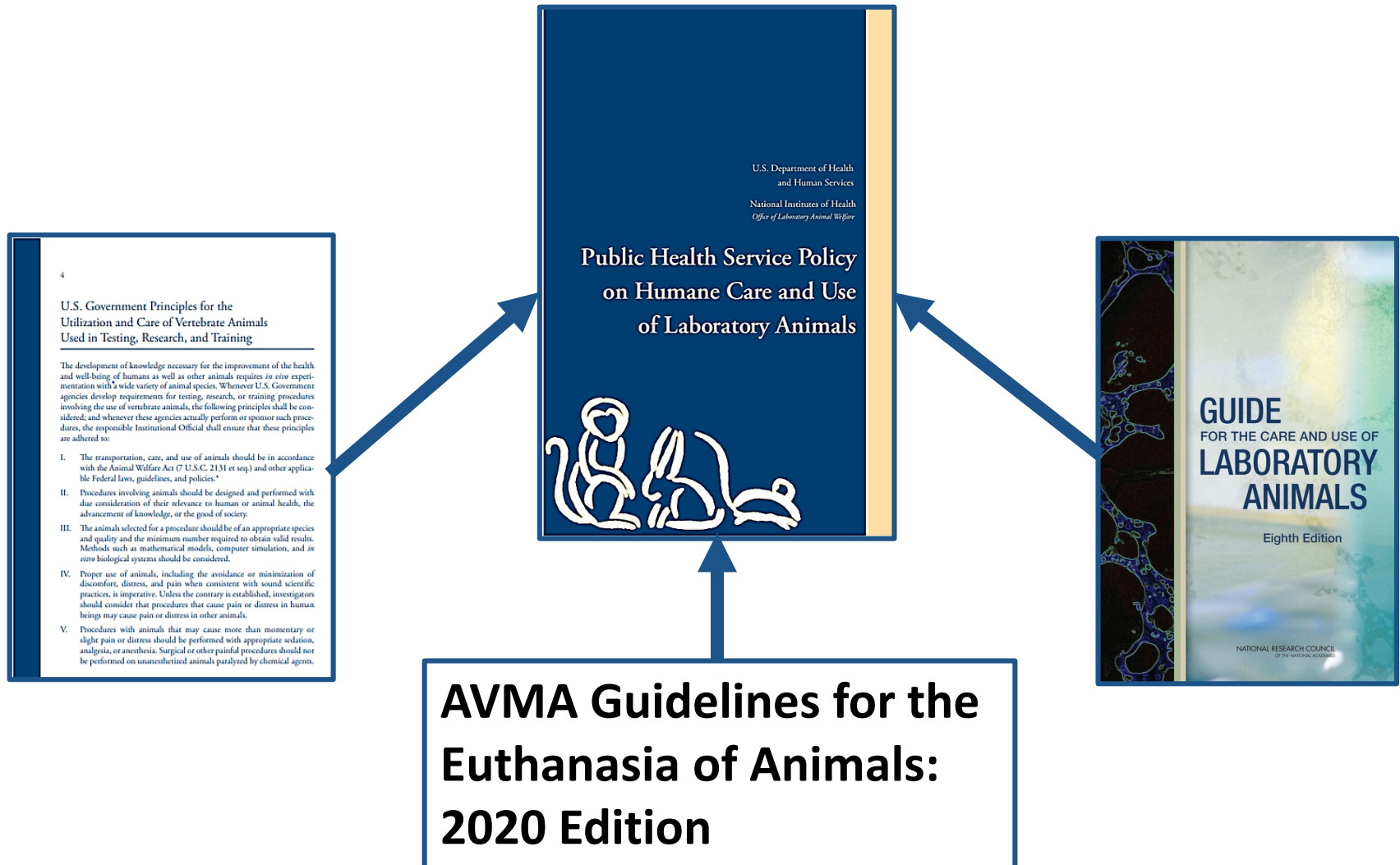


OLAW Online Seminar  
September 10, 2020

Axel Wolff, MS, DVM, NIH, Office of Laboratory Animal Welfare

Samuel Cartner, DVM, PhD, DAACLAM, University of Alabama at Birmingham

# The PHS Policy References the AVMA Euthanasia Guidelines



# OLAW is Committed to Using Sound Professional Guidance

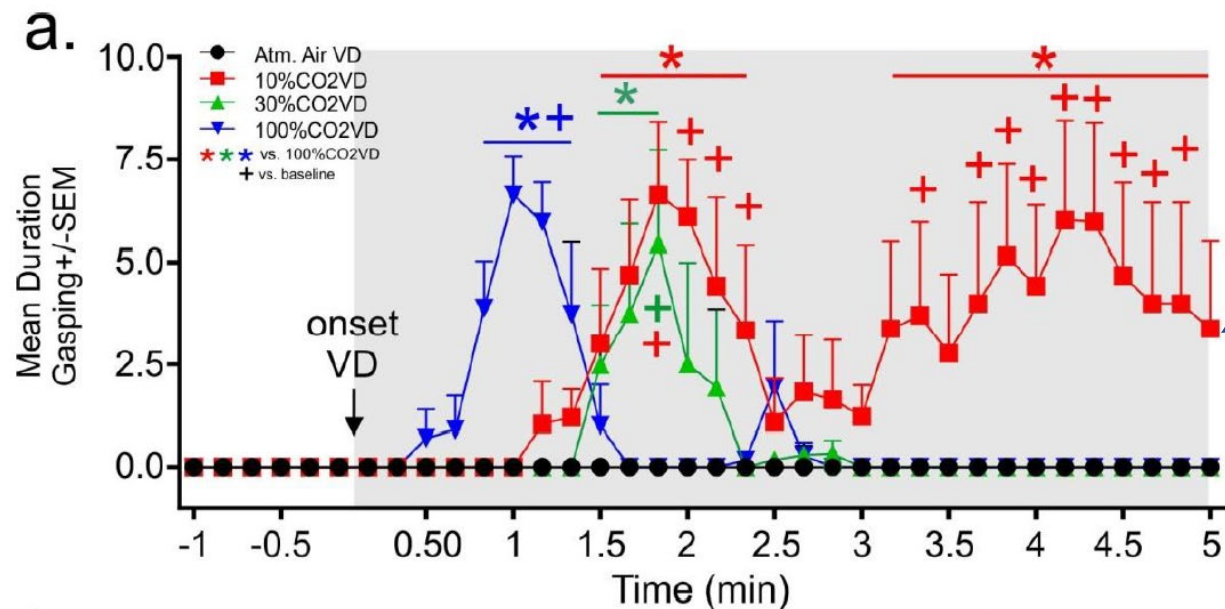


The AVMA  
Guidelines are  
Based on  
Peer-Reviewed  
Scientific  
Literature





# CO<sub>2</sub> Flow Rate Recommendations Revised Based on New Studies



10% Flow resulted in signs of prolonged distress

Hickman, D. L., Fitz, S. D., Bernabe, C. S., Caliman, I. F., Haulcomb, M. M., Federici, L. M., ... & Johnson, P. L. (2016). Evaluation of low versus high volume per minute displacement CO<sub>2</sub> methods of euthanasia in the induction and duration of panic-associated behavior and physiology. *Animals*, 6(8), 45.

# Scientific Debate Leads to Improvement



## Decisions Should Not be Based on:

- 
- **Cost**
  - **Convenience**
  - **Tradition**
  - **Unsupported Anecdotes**



# Public Comments

## Request for Information (RFI) on the Implementation of the Updated AVMA Guidelines for the Euthanasia of Animals: 2020 Edition

Notice Number: NOT-OD-20-069

### Key Dates

**Release Date:** February 24, 2020

**Response Date:** April 29, 2020

### Related Announcements

[NOT-OD-20-143](#) - Grant and Contract Submission Requirements Regarding the Updated AVMA Guidelines for the Euthanasia of Animals: 2020 Edition

[NOT-OD-20-132](#) - Public Comments on the Implementation of the Updated AVMA Guidelines for the Euthanasia of Animals: 2020 Edition

### Issued by

National Institutes of Health ([NIH](#))

### Purpose

This Request for Information (RFI) is to solicit input from the public on any concerns they may have with the updated American Veterinary Medical Association (AVMA) Guidelines for the Euthanasia of Animals: 2020 Edition ("Guidelines") and provide guidance to Public Health Service (PHS) and National Science Foundation funded institutions on implementation of the updated Guidelines.

**OLAW expects full implementation after October 1st, 2020.**



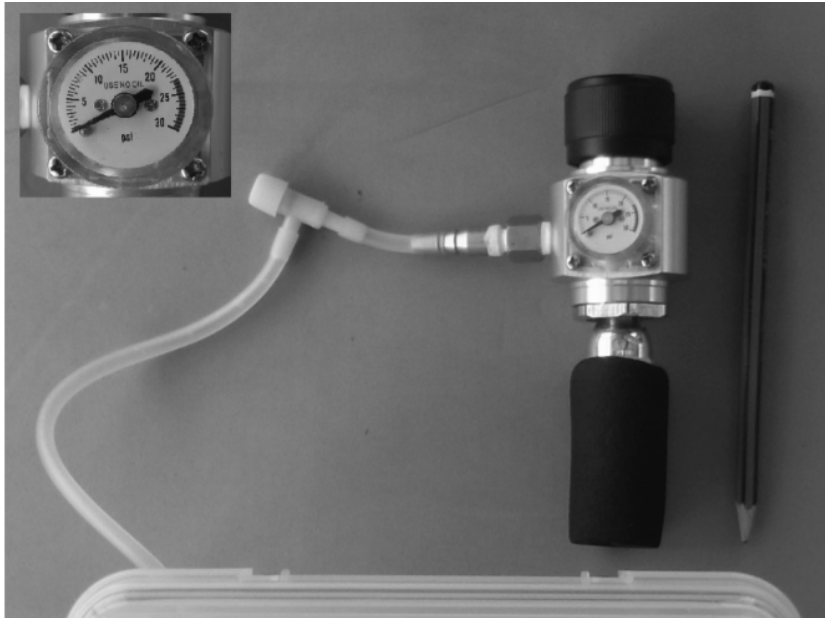
National Institutes of Health  
Office of Laboratory Animal Welfare



# Manual Blunt Force as a Method of Euthanasia



# Cardiac Compression in Birds

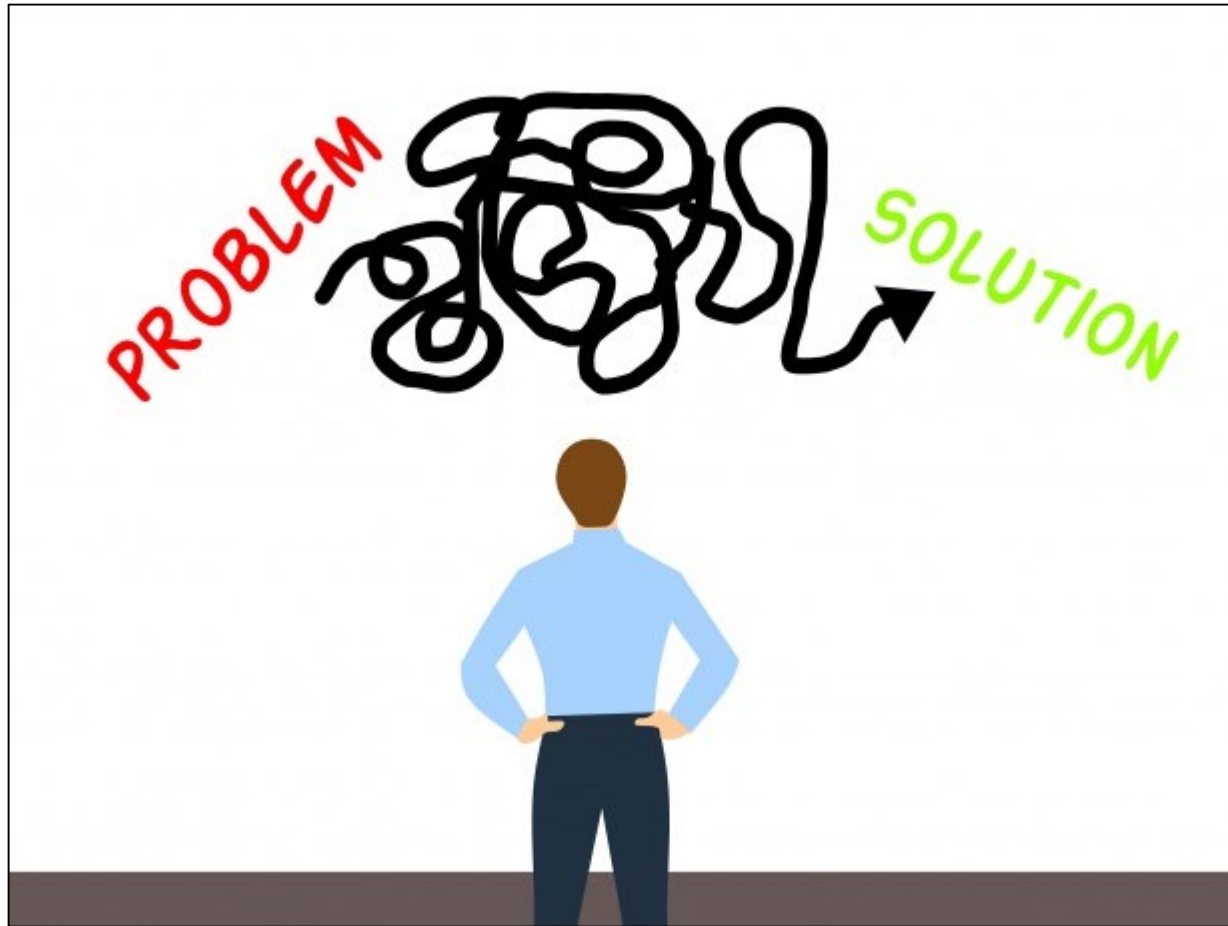


<https://olaw.nih.gov/education/educational-resources/webinar-2018-03-28.htm>

Ellis, M. V. (2017). Development of a compact system for field euthanasia of small mammals. *Journal of Mammalogy*, 98(4), 1211-1214.



# Scientific Justifications Allow Flexibility



# AVMA Guidelines for the Euthanasia of Animals: 2020 Edition

Dr. Sam Cartner

University of Alabama at Birmingham  
Chair Laboratory Animals Working  
Group

September 10, 2020

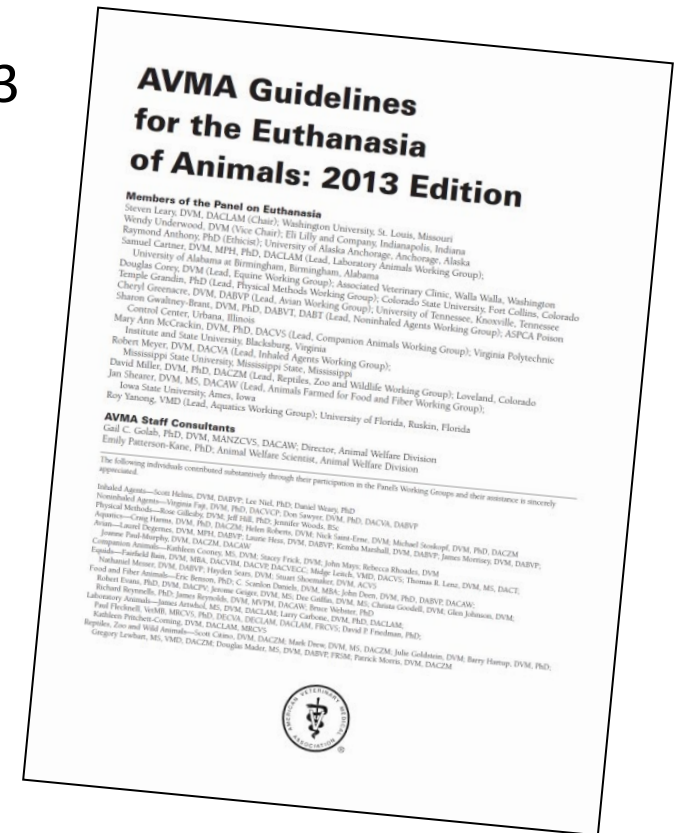




# History of the AVMA's Panel on Euthanasia

## 2020

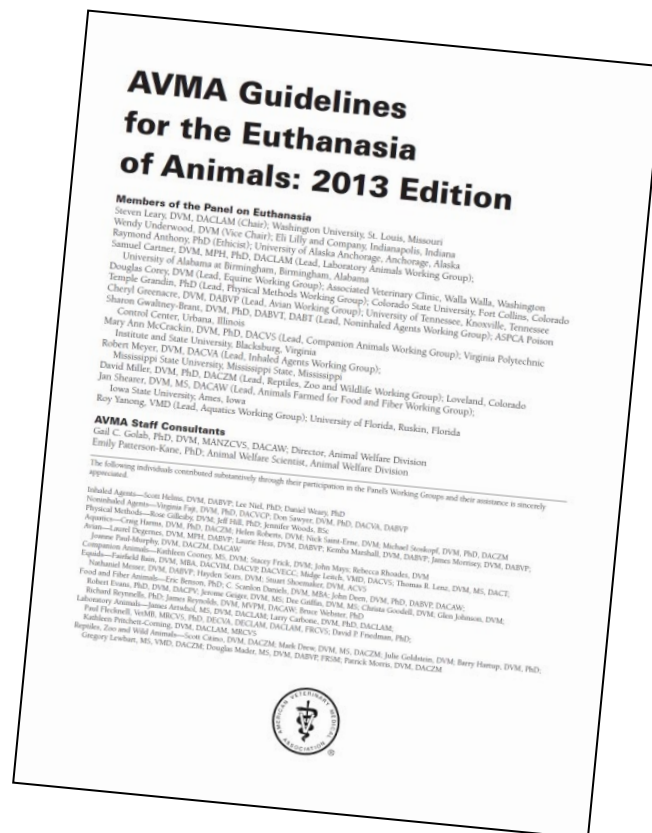
- 14 panel members, 11 working groups (3 techniques groups, 8 species groups), ethicist. Most participated on the 2013 Edition
- Opportunity for member comment
- Exist as a virtual entity to respond to inquiries
- Deliberate separation of euthanasia, humane slaughter, and depopulation → “Humane Endings”
- Commitment to data-based improvements that meet societal needs



# History of the AVMA's Panel on Euthanasia

## 2013

- Introduction emphasizes process prior to and after euthanasia
  - “end of life decisions” and “life worth living”
- Diagrams and specific guidance on some techniques
- Glossary
  - Unconsciousness=loss of righting reflex
- Changed “Conditionally Acceptable” to “Acceptable with Conditions”
- No reference/requirement for scientific justification



# History of the AVMA's Panel on Euthanasia

## 2013

- Cervical dislocation of poultry (turkeys)
  - “Appropriate size”
- Thoracic compression
  - Unacceptable
- Captive invertebrates
  - Spiders, insects
- Emphasized 10-30% gradual displacement rate for laboratory rodents

# Guidelines for the Euthanasia of Animals

## Update for Laboratory Animals

### Laboratory Animal Working Group

- Sam Cartner, DVM, PhD, DACLAM - Chair
- Larry Carbone, DVM, PhD, DACLAM
- Paul Flecknell, VetMB, MRCVS, PhD, DECVA, DECLAM, DACLAM
- David P. Friedman, PhD
- Debra Hickman, DVM, DACLAM, DACAW
- Kathleen Pritchett-Corning, DVM, DACLAM, MRCVS



# Introduction

Distinguished between states of awareness

- **Unconscious** - loss of awareness and is associated with loss of righting reflex
- **Sedated or tranquilized** - can be aroused with sufficient stimulation

# Laboratory Animals

## Inhalants - Carbon Dioxide for Rodents

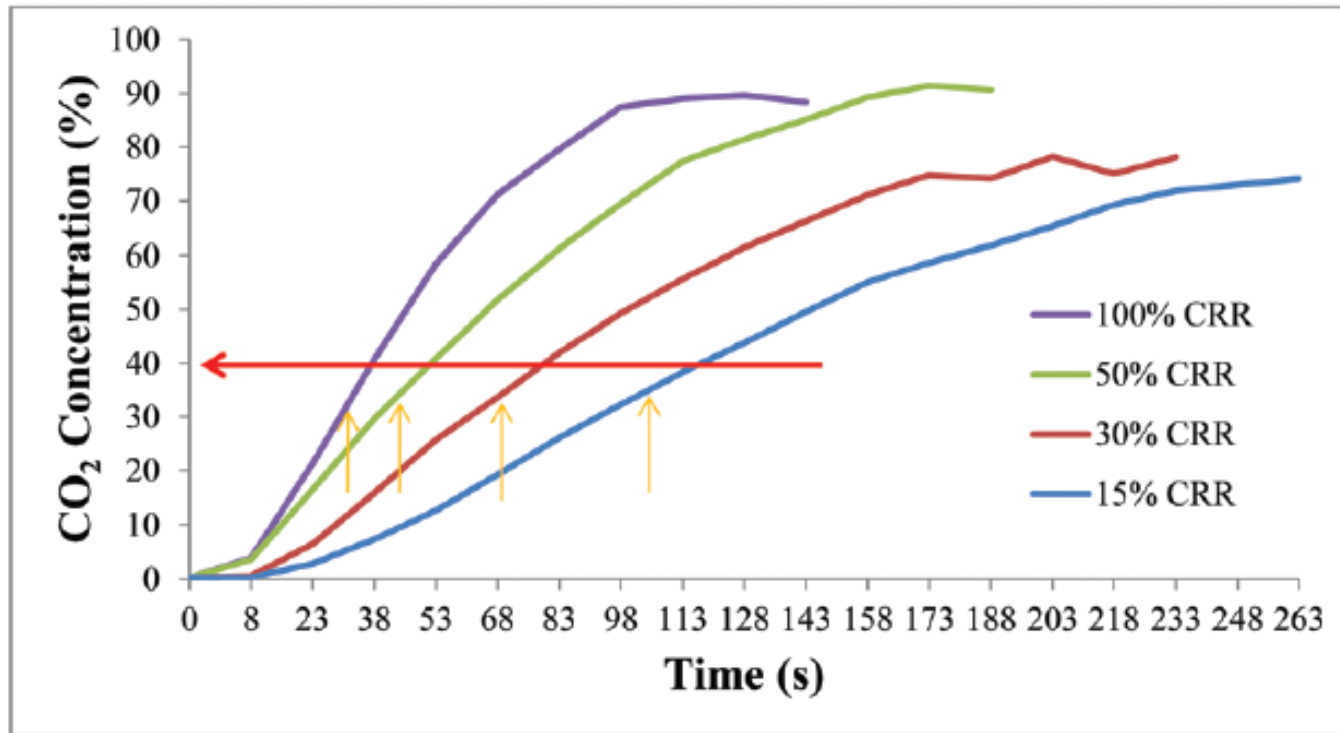
- CO<sub>2</sub> flow rate recommendation for rodents to 30-70%
- Previously 10-30%
- Based on much research looking at different flow rates
- Potential for distress at lower flow rates
- Potential for mucous membrane pain at higher flow rates

# Physiological, Behavioral, and Histological Response of Male C57BL/6N Mice to Different CO<sub>2</sub> Chamber Replacement Rates

Gregory P Boivin,<sup>1,2\*</sup> Michael A Bottomly,<sup>3</sup> Emily S Dudley,<sup>1</sup> Patricia A Schiml,<sup>4</sup> Christopher N Wyatt<sup>5</sup>, Dadja Grube<sup>6</sup>

“...activity levels, behavioral responses, plasma adrenocorticotrophic hormone and corticosterone levels, and lung pathology were not different between groups. We found no physiological, behavioral, or histologic evidence that 15% or 30% CO<sub>2</sub> CRR is less painful or distressful than is 50% or 100% CO<sub>2</sub> CRR. **We conclude that 50% to 100% CO<sub>2</sub> CRR is acceptable for euthanizing adult male C57BL/6N mice.**”

# Boivin - Full Recumbency



**Figure 1.** CO<sub>2</sub> concentration in the home cage with different CO<sub>2</sub> chamber replacement rates (CRR). The red arrow is the level at which pain occurs. Each of the yellow arrows represents the point of full recumbency (nose down) of the mice at the respective CO<sub>2</sub> CRR.





*Article*

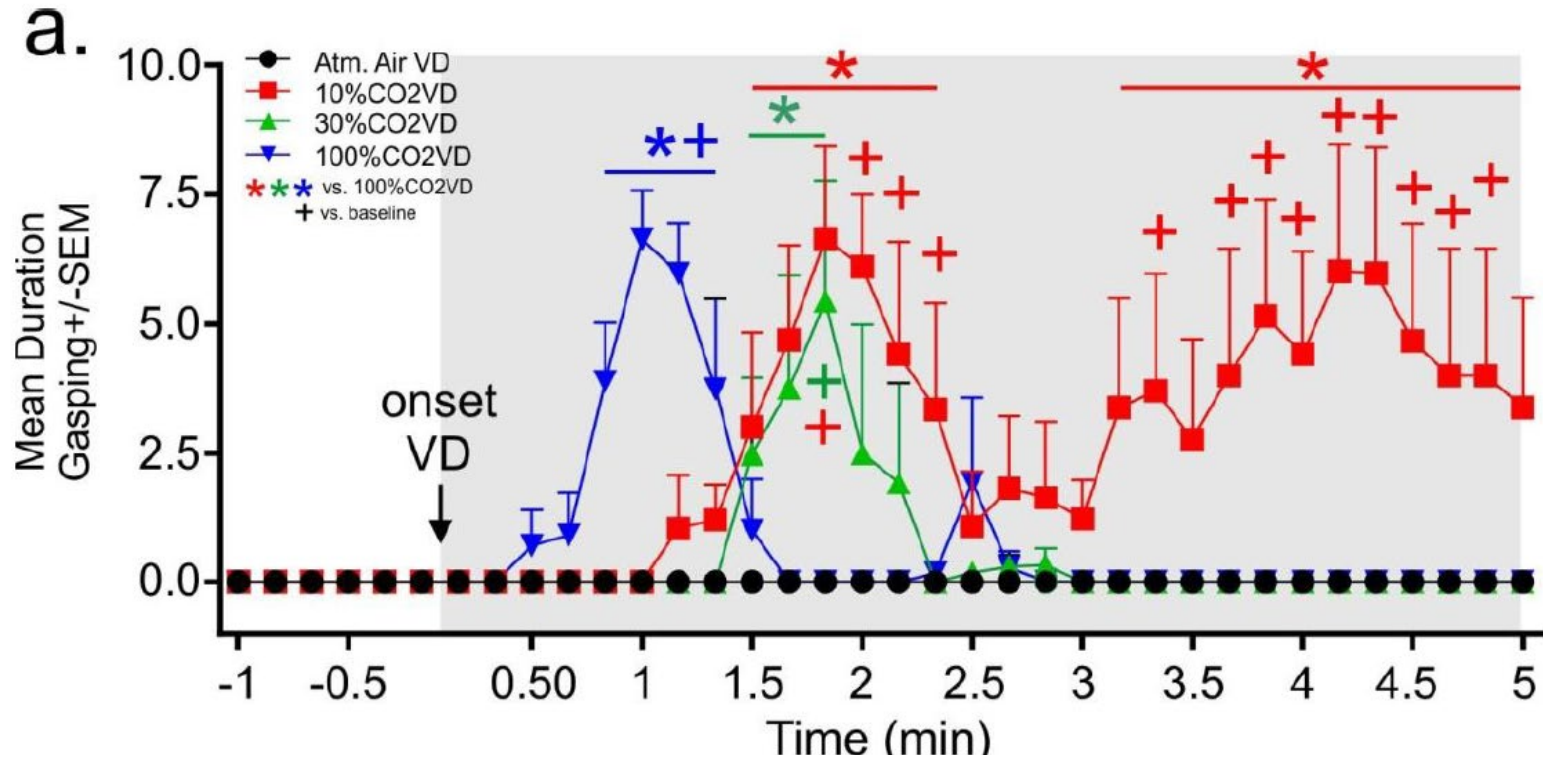
## **Evaluation of Low versus High Volume per Minute Displacement CO<sub>2</sub> Methods of Euthanasia in the Induction and Duration of Panic-Associated Behavior and Physiology**

Debra L. Hickman <sup>1,2,3,\*</sup>, Stephanie D. Fitz <sup>4</sup>, Cristian S. Bernabe <sup>3,5</sup>, Izabela F. Caliman <sup>5</sup>, Melissa M. Haulcomb <sup>4</sup>, Lauren M. Federici <sup>3,5</sup>, Anantha Shekhar <sup>4,6</sup> and Philip L. Johnson <sup>3,5</sup>

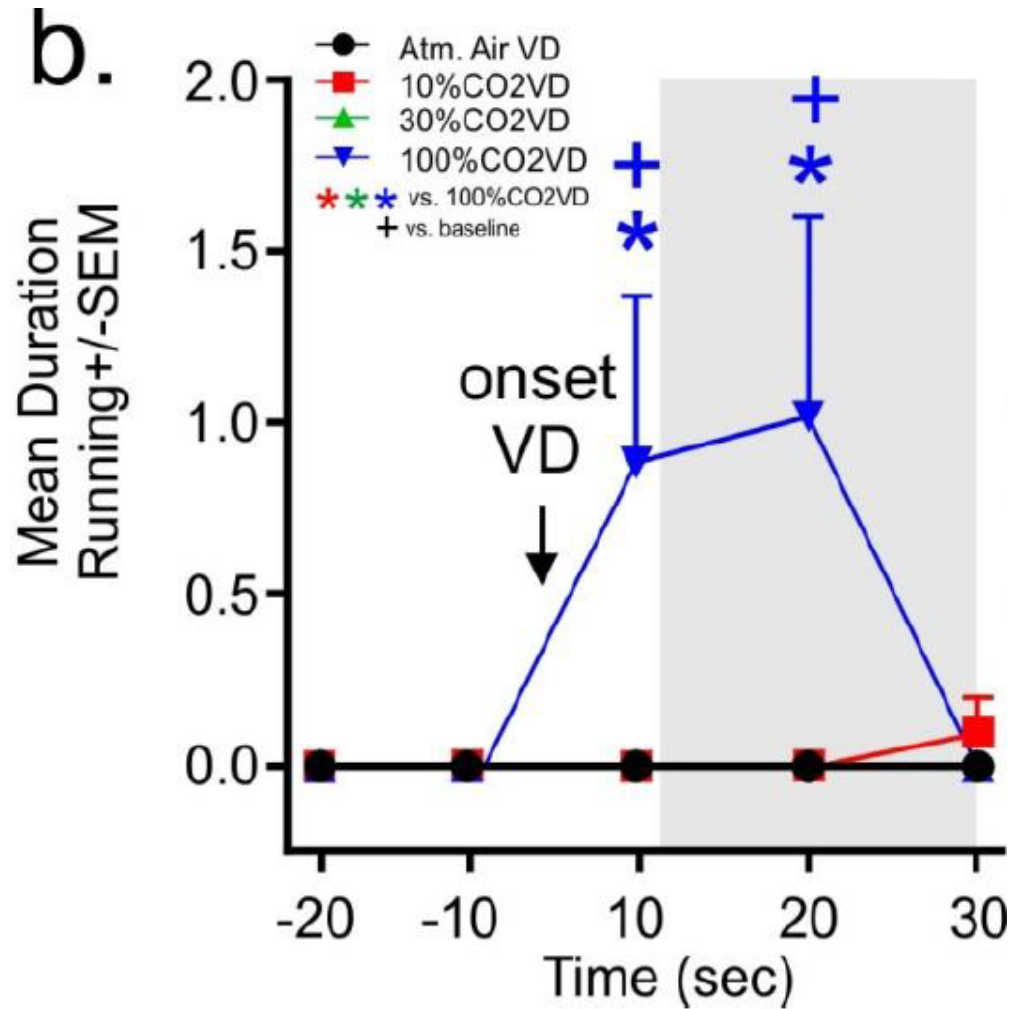
*Animals* **2016**, *6*, 45; doi:10.3390/ani6080045

- Compared 10%, 30% and 100% displacement rates of chamber using rats
- 10% prolonged the panicogenic responses
- Higher flow volume increased agitation

# Hickman - Prolonged Gaspings



# Hickman - Running Behavior



# Laboratory Animals

## Rabbits – Acceptable with Conditions

- Non-penetrating captive bolt
- CO<sub>2</sub> (50-60% volume change/min)
- Cervical dislocation
- Blunt force trauma – only for emergencies and when lacking resources





*Article*

# **Efficacy of Blunt Force Trauma, a Novel Mechanical Cervical Dislocation Device, and a Non-Penetrating Captive Bolt Device for On-Farm Euthanasia of Pre-Weaned Kits, Growers, and Adult Commercial Meat Rabbits**

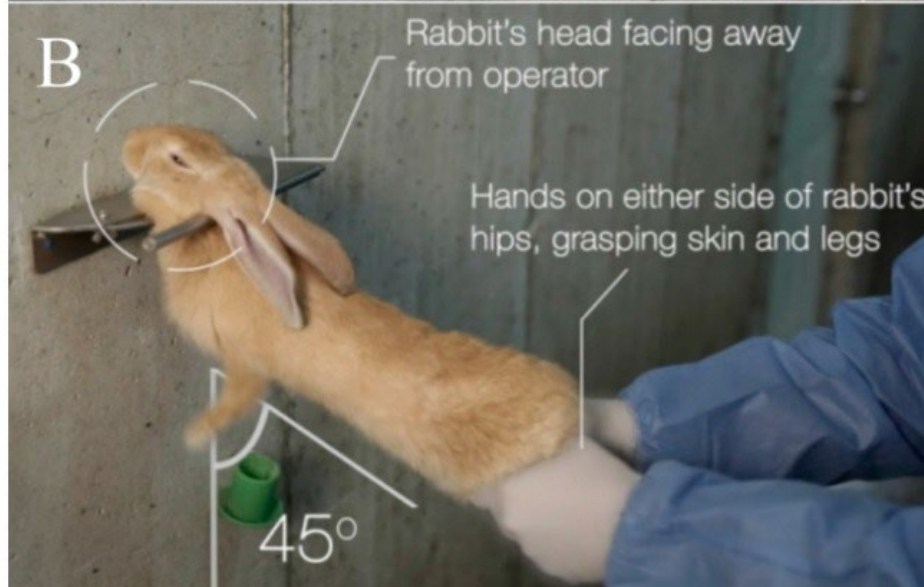
Jessica L. Walsh, Aaron Percival and Patricia V. Turner  
*Animals* **2017**, *7*, 100; doi:10.3390/ani7120100

- Historically blunt force trauma (BFT) most common on-farm method
- Discontinued in some abattoirs due to concerns about efficacy and operator fatigue
- Study evaluated 3 methods in 3 sizes of rabbits
- Insensibility: absence of brainstem and spinal reflexes, rhythmic breathing, and vocalizations
- Pathological evaluation of the degree of induced brain damage









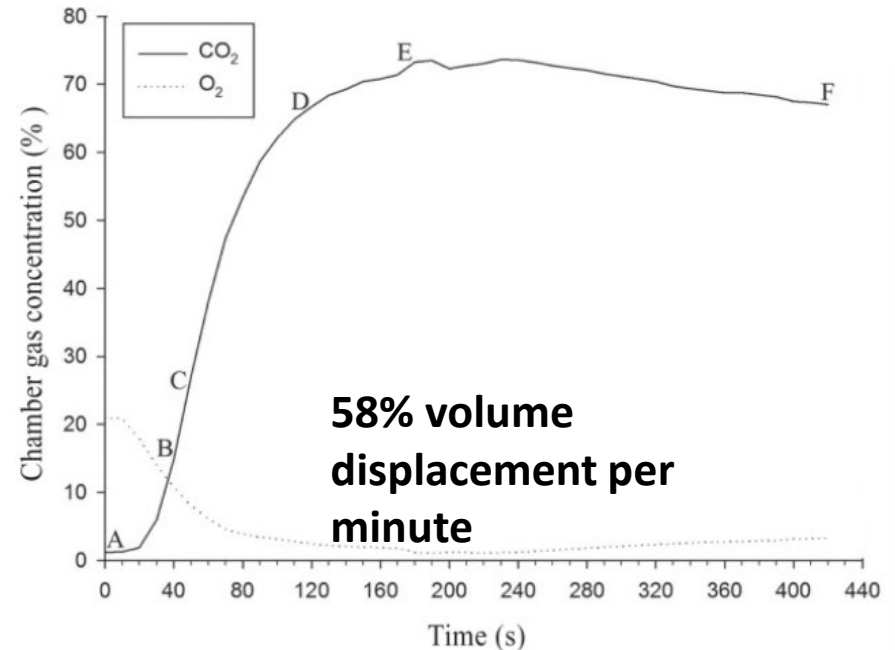
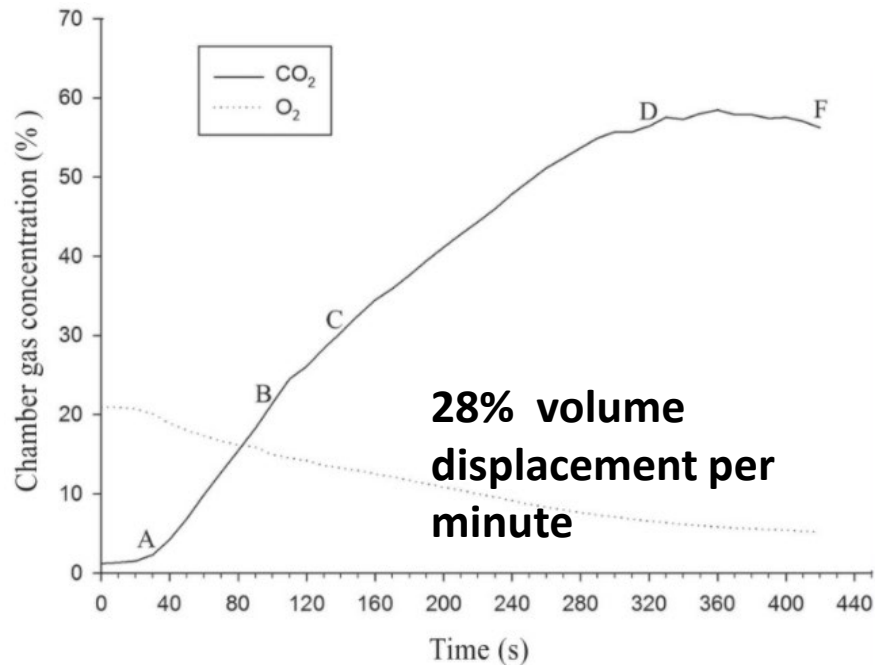
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Jessica L. Walsh, Aaron Percival, and Patricia V. Turner

Method	Number	Successfully Euthanized
Blunt Force Trauma (BFT)	58	78%
Non-Penetrating Captive Bolt (NPCB)	63	100%
Mechanical Cervical Dislocation (MCD)	49	94%

# Euthanasia of meat rabbits with carbon dioxide: Behavioral and physiologic responses to gas chamber gradual- and fast-fill rates

Jessica L. Walsh, John Van de Vegte, Brianne Mercer, Patricia V. Turner



A=Increased Respiration  
B=Loss of Righting Reflex

C=Loss of Corneal Reflex  
D=Last Breath

F=Gas Off



# On Farm CO<sub>2</sub> Euthanasia Chamber



*Canadian Veterinary Journal 2019 60(7):770-778*

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# Other Changes

## 2020 Edition

### Livestock

- CO<sub>2</sub> Acceptable with Conditions for neonatal kid goats (< 3wk)
- Updated images for bovids to match the Guidelines for Humane Slaughter of Animals
- Updated images for small ruminants to match the Guidelines for Humane Slaughter of Animals
- New images for proper positioning for captive bolt use (llama, alpaca, deer, water buffalo, bison, chicken, turkey)
- Bovine poll shot not to be used as a primary method, as necessary by trained personnel as required for reasons of accessibility or safety
- Puntilla of camelids - Unacceptable

# Selected Changes

## 2020 Edition

### Avian Eggs

- Destruction by cooling or freezing must occur prior to 80% of incubation

### Poultry

- Clarify CO<sub>2</sub> flow rate standards for laboratory rodents and rabbits do not apply to poultry or swine

### Equine

- Anesthetized horses can be euthanized with
  - 2% lidocaine 60 ml injected intrathecal
  - KCl - IV/IC
  - MgSO<sub>4</sub> - IV

# Selected Draft Changes

## 2018 Interim Update

### Aquatics

- Addition of exsanguination as a secondary step
- Categorization of MS222 unchanged/acceptable
  - Immersion time extended from 10 to 30 mins
- Metomidate would be considered acceptable if index status changes
- Information added about aversion and potential need for secondary step in some cases

# Selected Draft Changes

## 2018 Interim Update

### Unchanged at this time - Unacceptable

- Thoracic compression
- Rapid freezing of reptiles
- Drowning

### Not added at this time

- Cranial injection of ethanol for ducks or other poultry
- Use of lidocaine with IP barbiturate

# Comparison of intraosseous pentobarbital administration and thoracic compression for euthanasia of anesthetized sparrows (*Passer domesticus*) and starlings (*Sturnus vulgaris*)

Paul-Murphy JR; et. al. American Journal of Veterinary Research, 2017;78(8)887-889

## Gross pathological changes:

“Among birds euthanized by TC [thoracic compression], 9 of 10 sparrows and 5 of 7 starlings had grossly visible coelomic, pericardial, or perihepatic hemorrhage.”



# AVMA Panel at Work



Next full update due ~2023

# THANK YOU

Special Thanks to Drs. Emily Patterson-Kane,  
Dr. Cia Johnson, and the AVMA staff



# Question 1:

The Guidelines address how to conduct the most humane methods of euthanasia for animals, but what about the people who perform such procedures?

Compassion fatigue is an important issue. Is there any guidance available on mitigating the impact of end-of-life decisions and euthanasia on care staff?

# Question 1: Answer

The AVMA recognizes this need and has initiated a Working Group under the oversight of the Steering Committee on Human Animal Interactions. They welcome a representative from OLAW.



## Question 2:

Why were data from other mammalian species used to conclude that rodent fetuses are unconscious in utero? Rodents differ from humans and other vertebrates in some very significant ways. What data show that results from research in other species are applicable?



## Question 2: Answer

The Guidelines reference Dr. Mellor's work from the Massey University in New Zealand. He has published many papers on mammalian development in many species. He describes that the general pattern of neurological development appears to be similar across most mammals, irrespective of when the capacities for sentience and conscious perception first appear in relation to the timing of birth.

The Panel on Euthanasia agreed with Mellor and, based on work in other mammalian species, concluded that rodent fetuses are likely to be unconscious in utero and that hypoxia, thereby, would not evoke a response.



## Question 3:

On page 76, section 3.3.3 of the 2020 Guidelines, the correct application of manually applied blunt force trauma is categorized as an acceptable means of euthanasia for suckling pigs. If this is the case, why does the AVMA recommend actively searching for alternatives to this method?

## Question 3: Answer

The panel made this recommendation because they recognize that individuals performing blunt force trauma must be well trained and must not become physically fatigued such that performance of the technique is negatively impacted.

Further, manually applied blunt force trauma is aesthetically displeasing and potentially distressing to individuals asked to perform the technique. Psychological impacts on individuals performing the euthanasia technique and general societal acceptance are a few of the many variables that must be weighed when deliberating the choice of a euthanasia method.

## Question 4:

Some literature strongly suggests that rapid freezing would meet the definition of euthanasia for amphibians and reptiles. In section 7.3.7, why does the AVMA limit rapid freezing to amphibians and reptiles < 4 g (0.1 oz) and require a secondary method?

## Question 4: Answer

The AVMA continues to support the designation of hypothermia or freezing of amphibians and reptiles as unacceptable in animals > 4 g in weight. Rapid freezing should **only** be used for amphibians and reptiles < 4 g in weight **and** a secondary method should be used to ensure death has occurred and is irreversible.

This method is based on rodent models and likely will work for ectothermic vertebrates that fall within in this weight range. However, the use of hypothermia/freezing as a euthanasia method for these species lacks the appropriate scientific literature support to document that it meets the criteria set forth in the Guidelines for the Euthanasia of Animals: 2020 Edition.

## Question 5:

The 2020 Guidelines specify a temperature range for rapid chilling of zebrafish from 2-4°C. However, a 2018 study by Wallace et al. suggests a range of 0-4°C may be more appropriate. Has the Panel considered the information in this publication when revising the Guidelines?

Wallace, C. K., Bright, L. A., Marx, J. O., Andersen, R. P., Mullins, M. C., & Carty, A. J. (2018). Effectiveness of rapid cooling as a method of euthanasia for young zebrafish (*Danio rerio*). *Journal of the American Association for Laboratory Animal Science*, 57(1), 58-63.

## Question 5: Answer

The Panel on Euthanasia thanks the commenter for bringing this additional publication to the Panel's attention and will consider its content during the next update of the Guidelines.



## Question 6:

Some research projects require specific methods of euthanasia that are not acceptable under the AVMA Guidelines but are necessary to produce valid scientific results. How can investigators and IACUCs address this issue while maintaining compliance?



# Question 6: Answer

Methods of euthanasia that do not follow the most current version of the AVMA Guidelines for the Euthanasia of Animals may be acceptable if there is:

- Scientific justification
- IACUC review and approval

**Thank you!**



# Next OLAW Online Seminar: Topic to be Determined



OLAW Online Seminar  
December 10, 2020