

Analgesia & Anaesthesia in Rabbits & Rodents:



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Mammal Practice)



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Anaesthesia/Analgesia in Rabbits & Rodents

ANIMAL ETHICS INFOLINK

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Welcome

This website has been developed by the [Animal Research Review Panel](#) and [NSW Department of Primary Industries - Animal Welfare Branch](#). It aims to assist researchers, teachers and members of Animal Ethics Committees to access information about the operation of the *Animal Research Act 1985*, *Animal Research Regulation 2010* and The Code of Practice in New South Wales.

In addition to specific information about this legislation,

Thank You:

- ARRP
- Dr Robyn Gentle

Anaesthesia/Analgesia in Rabbits & Rodents

Introduction

Overview

- Anaesthesia
- Analgesia
- Anti-inflammatories
- Putting it all together
(aka; Multimodal Analgesia)

Anaesthesia/Analgesia in Rabbits & Rodents

Introduction

Anaesthesia/Analgesia Indications

- Any procedure that may involve pain
- Any invasive/surgical procedure
- Any procedure requiring immobility

Anaesthesia/Analgesia in Rabbits & Rodents

Introduction

Anaesthesia/Analgesia Indications

- Any procedure that may involve pain
- Any invasive/surgical procedure
- Any procedure requiring immobility
- Adapting to an increasing level of procedural complexity

Anaesthesia/Analgesia in Rabbits & Rodents

Introduction

Analgesia Importance

- Welfare & Ethical
- Medical

Anaesthesia/Analgesia in Rabbits & Rodents

Introduction

Analgesia Importance

- Welfare & Ethical
- Medical
- Research impact?

Anaesthesia/Analgesia in Rabbits & Rodents

Anaesthesia

Anaesthesia Indications

- Anaesthesia = 'Without sensation'
- Can be 'general' or 'regional'

Anaesthesia/Analgesia in Rabbits & Rodents

Anaesthesia

Anaesthesia Indications

- General
 - Unconsciousness?
 - Paralysis
 - Amnesia (humans only?)
 - Analgesia (humans & animals?)
 - Mechanism of action?

Anaesthesia/Analgesia in Rabbits & Rodents

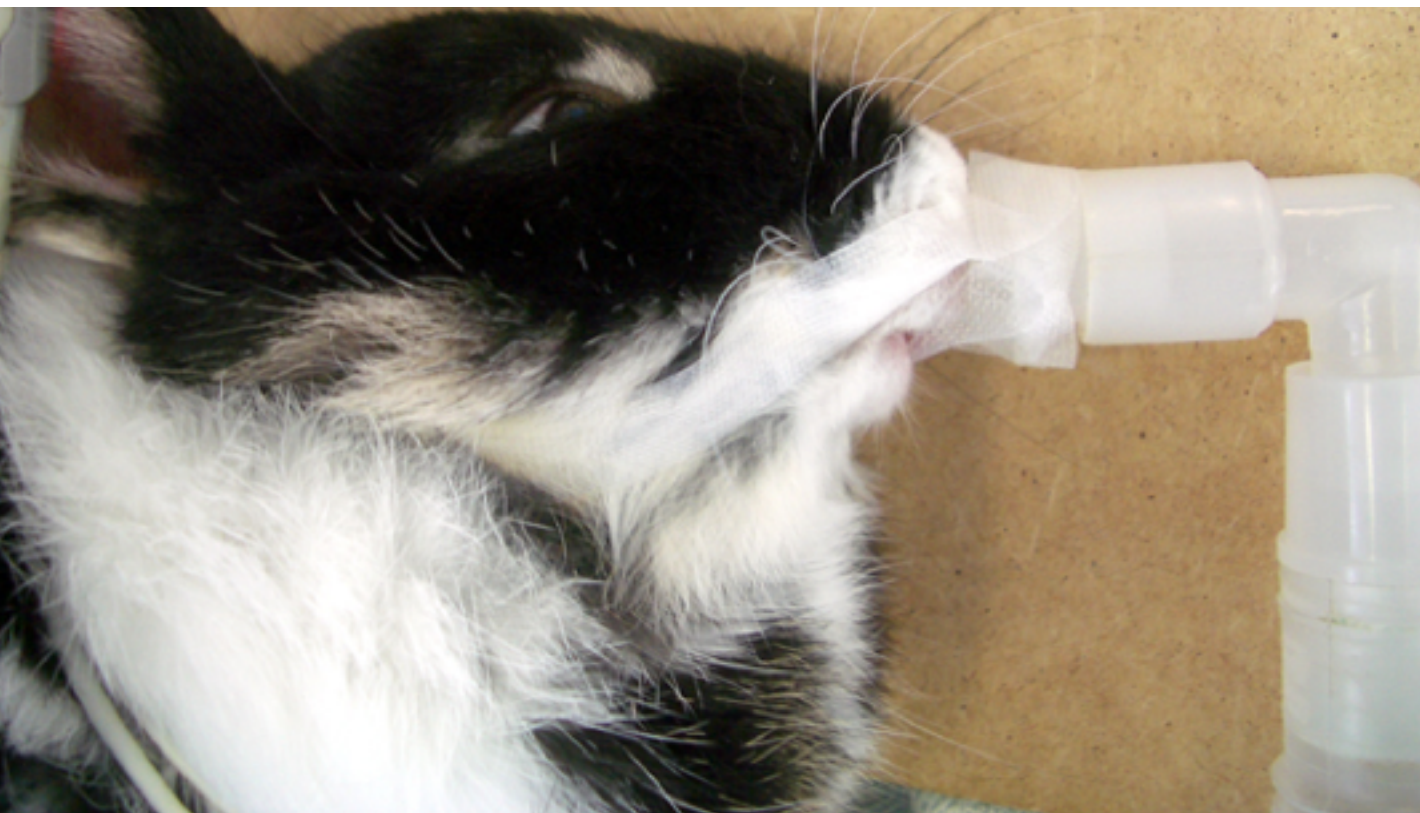
General Anaesthesia

- Gaseous v Parenteral



Anaesthesia/Analgesia in Rabbits & Rodents

Anaesthesia: Gaseous



O₂ supplementation

Anaesthesia/Analgesia in Rabbits & Rodents

Anaesthesia: Gaseous



Airway access: Rat

Jau IM, et al. 2000. Simplified rat intubation using a new oropharyngeal intubation wedge. *J Appl Physiol.* 89(5):1766-70.

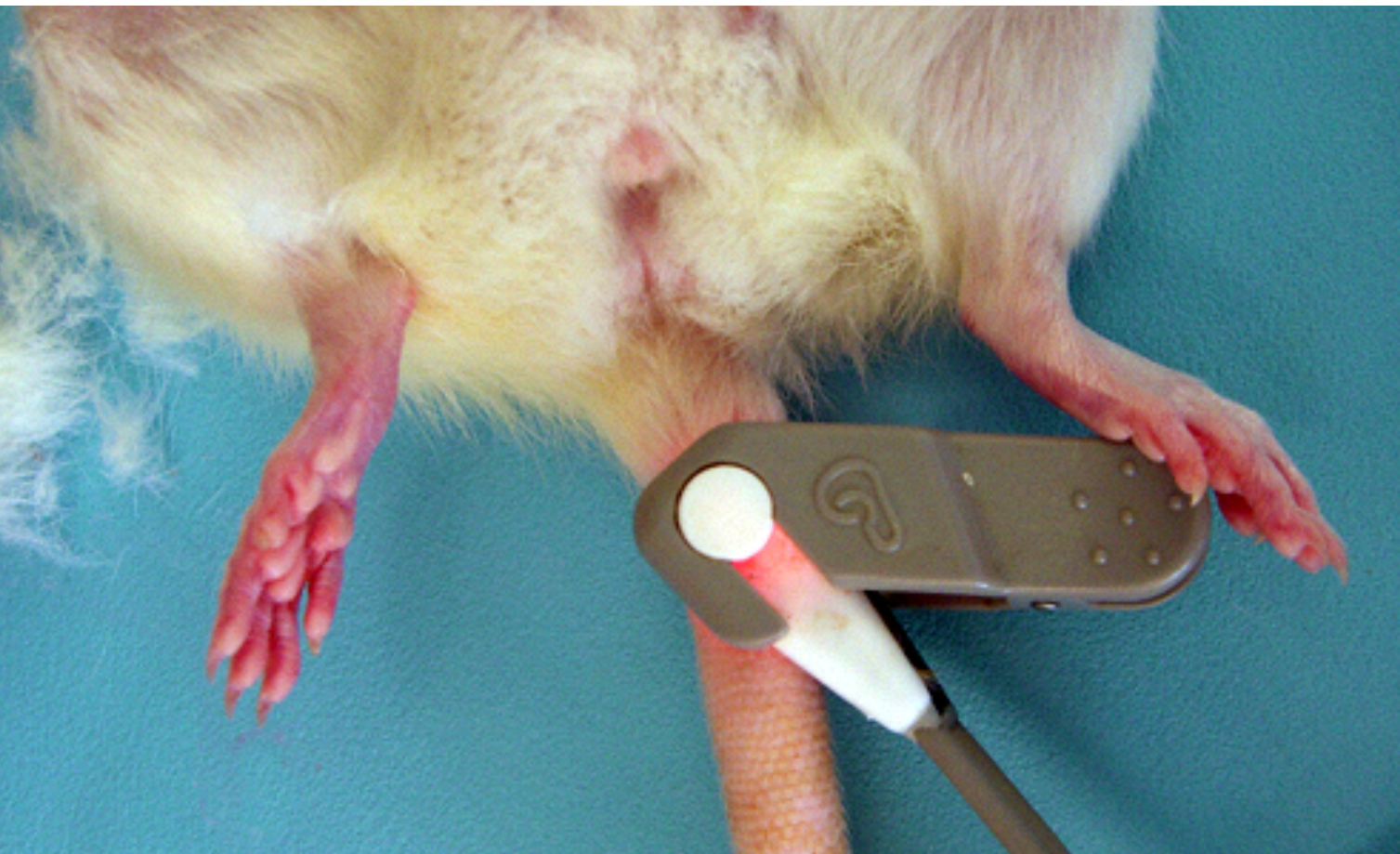
Anaesthesia/Analgesia in Rabbits & Rodents

General Anaesthesia

- Gaseous v Parenteral
- Ability to control depth of GA
 - Gaseous > Parenteral
- Ability to control recovery?
- Ability to control ongoing analgesia?

Anaesthesia/Analgesia in Rabbits & Rodents

Anaesthesia: Monitoring



Pulse oximetry &
End-tidal CO₂

Anaesthesia/Analgesia in Rabbits & Rodents

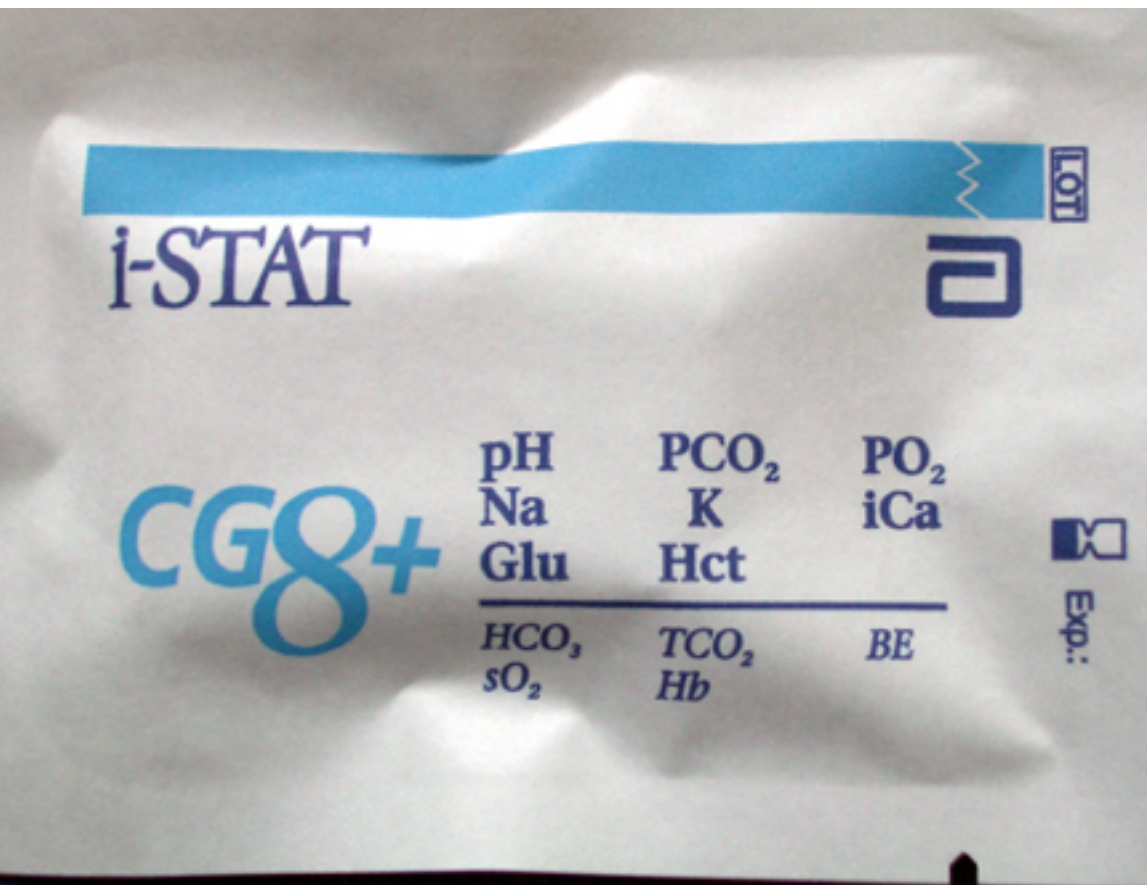
Anaesthesia: Monitoring



Blood Pressure &
ECG

Anaesthesia/Analgesia in Rabbits & Rodents

Anaesthesia: Monitoring



Blood Gas Analysis?

Anaesthesia/Analgesia in Rabbits & Rodents

Regional Anaesthesia

- Regional
 - Local anaesthesia
 - Nerve blocks
 - Epidural anaesthesia
 - Topical anaesthesia

Anaesthesia/Analgesia in Rabbits & Rodents

Regional Anaesthesia

- Mostly utilises local anaesthetics
- Lignocaine & bupivacaine (most common)
 - Infiltration of 'local' area

Anaesthesia/Analgesia in Rabbits & Rodents

Regional Anaesthesia

- Mostly utilises local anaesthetics
- Lignocaine & bupivacaine (most common)
 - Infiltration of 'local' area
 - Skin
 - Major nerve
 - Spinal cord
 - Mucous membranes
(conjunctiva, oral mucosa)

Anaesthesia/Analgesia in Rabbits & Rodents

Local Anaesthetics



Local Anaesthetics (LAs)

Lignocaine, Bupivacaine, Ropivacaine?

Anaesthesia/Analgesia in Rabbits & Rodents

Local Anaesthetics

Drug	Dose	Onset	Duration
Lignocaine	1 mg/kg	5-10min	1h
Bupivacaine	1 mg/kg	15-20min	2-6h

Drug delivery:

Local Anaesthetic Nerve blocks

Anaesthesia/Analgesia in Rabbits & Rodents

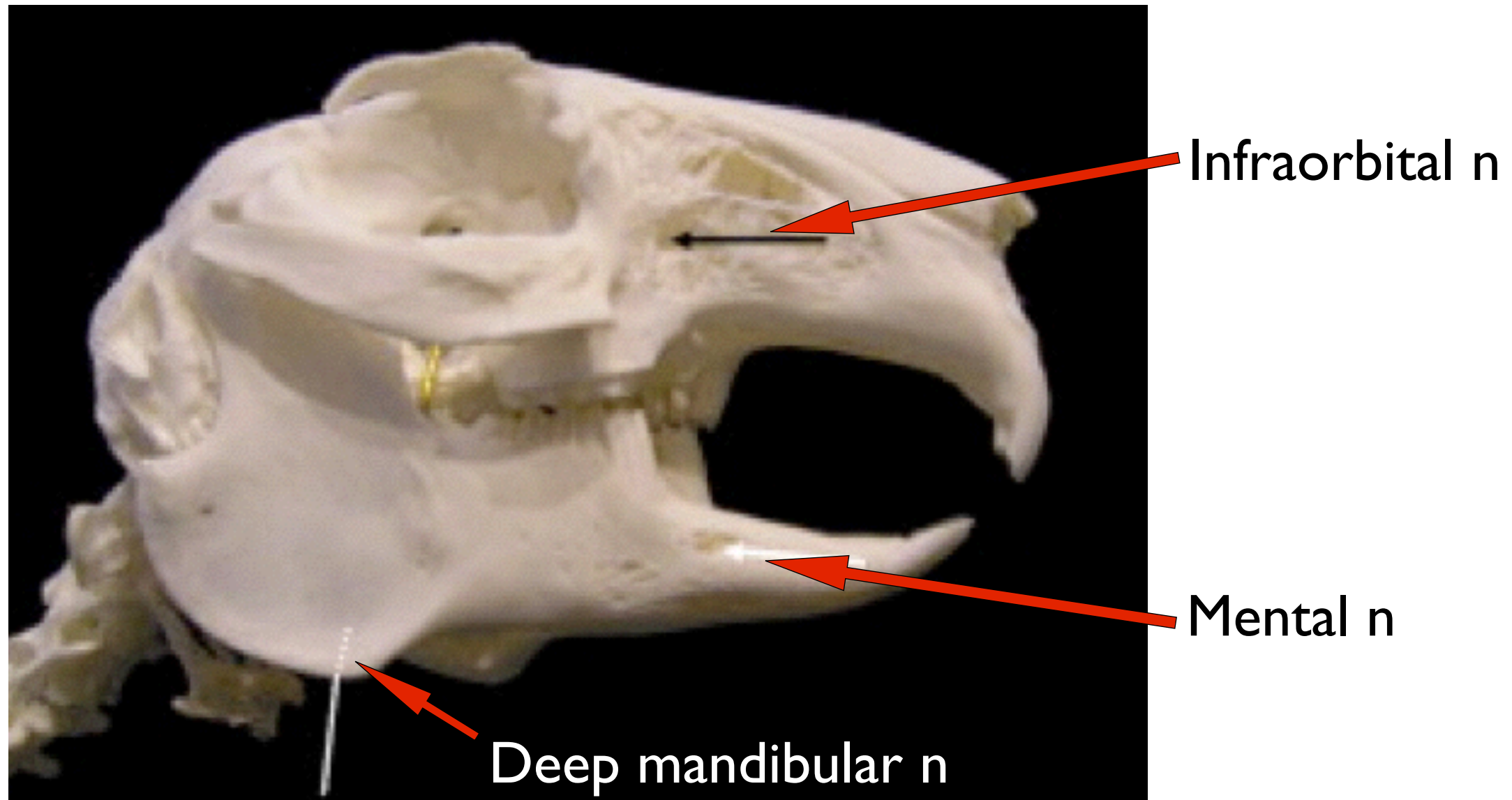
Local Anaesthesia



Drug delivery
Incisional block

Anaesthesia/Analgesia in Rabbits & Rodents

Local Anaesthesia



Drug delivery: Nerve blocks

Lichtenberger M. Ko J. 2007. Anesthesia and analgesia for small mammals and birds. *Vet Clin Exot Anim* 10: 293-315

Anaesthesia/Analgesia in Rabbits & Rodents

Local Anaesthesia



Drug delivery: Epidural Rabbit

Anaesthesia/Analgesia in Rabbits & Rodents

Local Anaesthesia

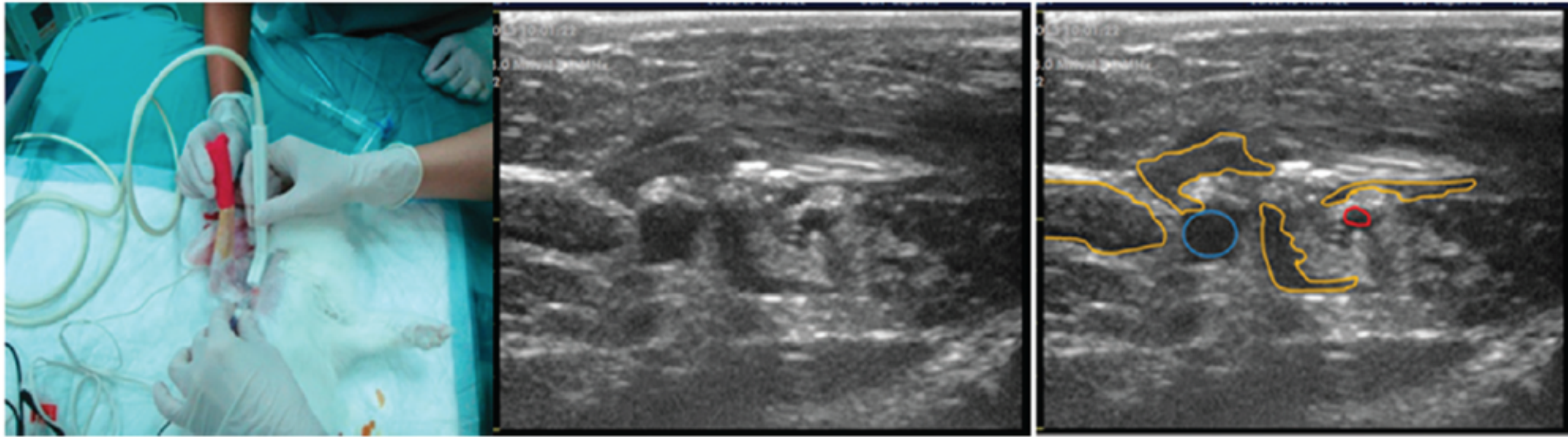


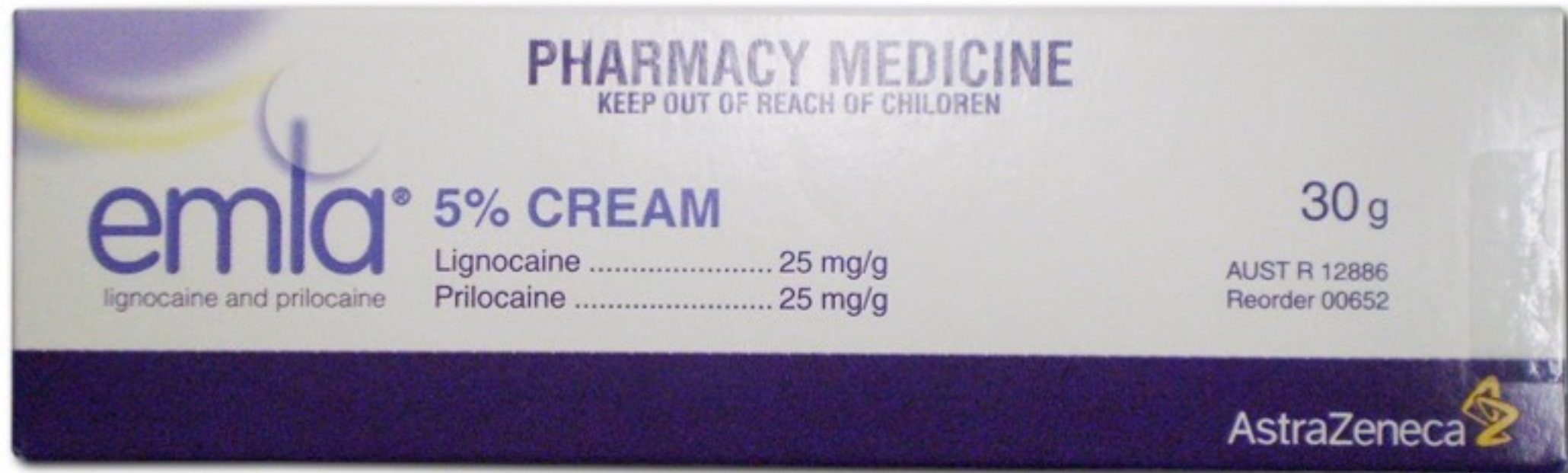
FIGURE 5 | Injection of ropivacaine around the brachial plexus. Final ultrasound image of ropivacaine (hypoechoic fluid, yellow outline) surrounding the brachial plexus (hyperechoic structures in straight relation to axillary vascular structures).

Fonseca C. et al. 2015. An ultrasound-guided technique for axillary brachial plexus nerve block in rabbits. *Lab An.* 44(5): 179-184

Drug delivery: Regional nerve
blocks: Brachial plexus (Rabbit)

Anaesthesia/Analgesia in Rabbits & Rodents

Local Anaesthetics



Local Anaesthetics (LAs)

Lignocaine, Prilocaine (Cutaneous, Mucous membranes)

Anaesthesia/Analgesia in Rabbits & Rodents

Local Anaesthetics



Drug delivery
Topical (cutaneous)

Anaesthesia/Analgesia in Rabbits & Rodents

Local Anaesthetics



Drug delivery
Topical (mucosal)

Anaesthesia/Analgesia in Rabbits & Rodents

Analgesic Classes



Local Anaesthetics (LAs)
Proparacaine (Ophthalmic)



European Rabbit
Oryctolagus cuniculus

‘Cursing you to calculus’

Analgesia in Rabbits & Rodents



North Shore Veterinary Specialist Centre
(Crows Nest, Sydney)

Anaesthesia/Analgesia in Rabbits & Rodents

Analgesia Considerations

- Lab animal
- Positive effects
 - Patient comfort & Quality of life
 - Reduce stress

Anaesthesia/Analgesia in Rabbits & Rodents

Analgesia Considerations

- Lab animal
- Positive effects
 - Patient comfort & Quality of life
 - Reduce stress
 - Improved physiological function
 - Improved wound healing
 - Improved surgical recovery

Anaesthesia/Analgesia in Rabbits & Rodents

Anaesthesia & Analgesia Considerations

- Rabbits & Rodents =
 - Relatively higher metabolic rates
 - ↑ Food intake
 - ↑ Glucose required
 - Propensity for gut stasis

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice



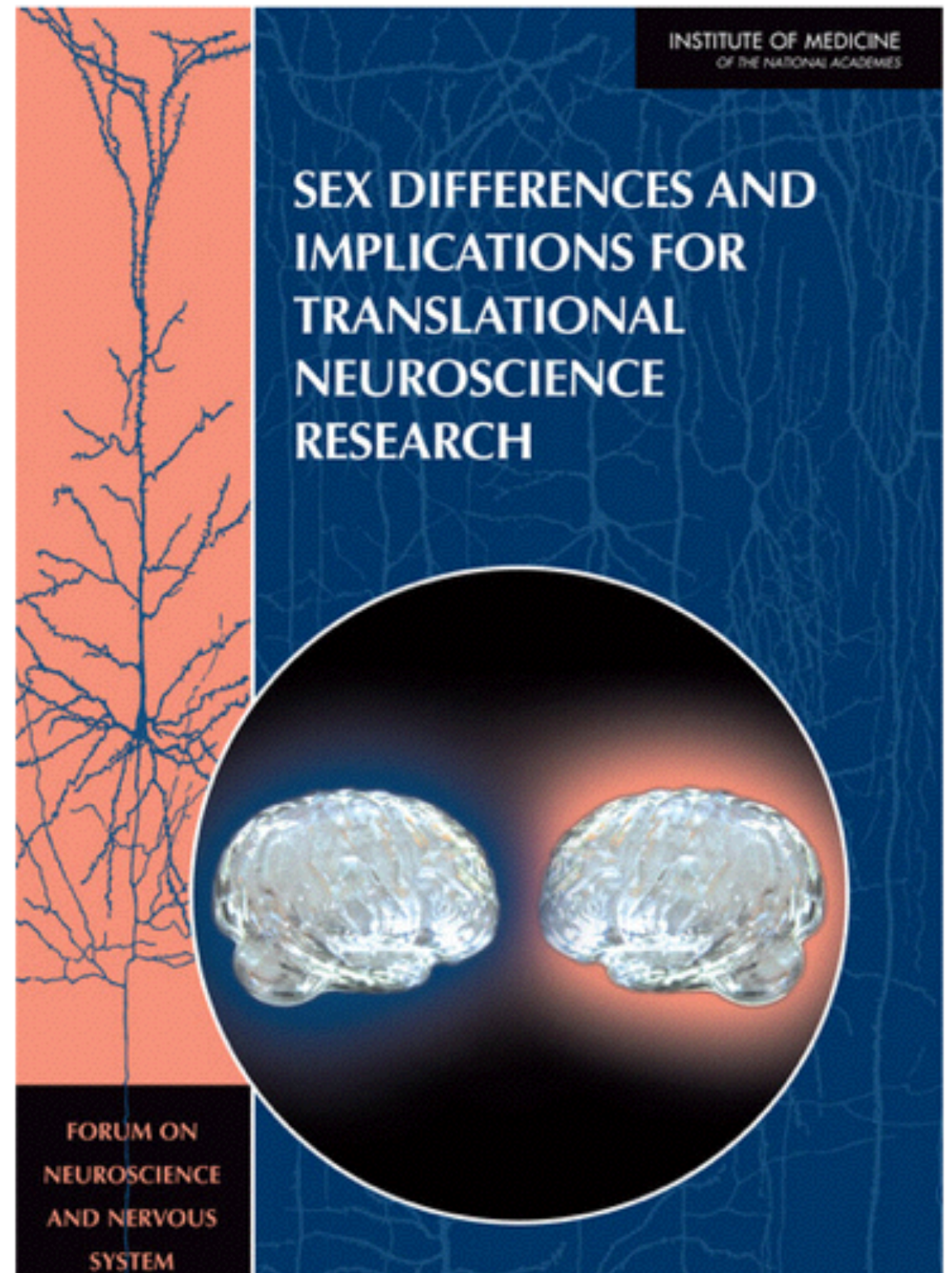
Breed, strain, gender differences?

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice

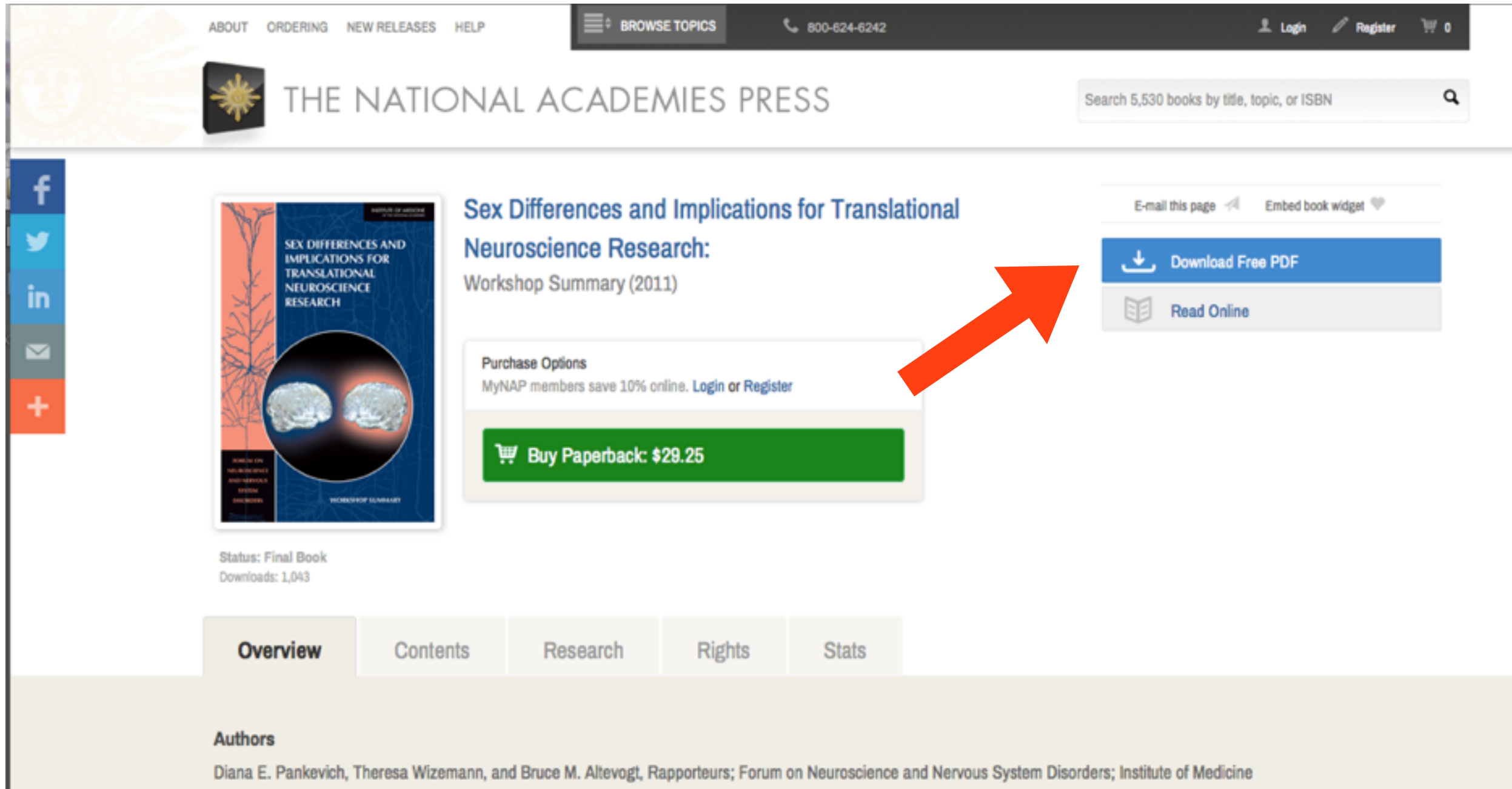
Gender differences?

- Workshop held to explore this (2011)



Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice



The screenshot displays the website of The National Academies Press. The header includes navigation links (ABOUT, ORDERING, NEW RELEASES, HELP), a search bar, and a phone number (800-624-6242). The main content area features the book cover for "Sex Differences and Implications for Translational Neuroscience Research: Workshop Summary (2011)". To the right of the cover, there are options to "E-mail this page" and "Embed book widget". Below these, a blue button labeled "Download Free PDF" is highlighted by a large red arrow. A grey button labeled "Read Online" is also visible. The "Purchase Options" section indicates that MyNAP members save 10% online and provides a green button to "Buy Paperback: \$29.25". The status of the book is "Final Book" with 1,043 downloads. The bottom section shows the authors: Diana E. Pankevich, Theresa Wizemann, and Bruce M. Altevogt, along with their affiliations.

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Overview Contents Research Rights Stats

Authors
Diana E. Pankevich, Theresa Wizemann, and Bruce M. Altevogt, Rapporteurs; Forum on Neuroscience and Nervous System Disorders; Institute of Medicine

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Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice

1. Sex bias? One review found 79% of pain studies (published in journal *Pain* over a 10 year period) utilised males only (Mogil and Chanda 2005)*
2. Sex differences in pain sensitivity? Females more sensitive and less tolerant of pain

*Mogil JS, Chanda ML. 2005. The case for the inclusion of female subjects in basic science studies of pain. *Pain*. 117(1-2):1-5.

Gender differences?

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice

3. Sex differences in pain processing?

- Melanocortin-1 receptor (MCR) mediates female specific mechanisms of analgesia in mice and humans (ie, 'red haired' individuals)
- Dextromethorphan potentiation of morphine. Works in men but not women
- Toll-like receptor 4 (TLR4) role in pain is entirely male specific

Gender differences?

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice



Drug Availability?

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice



Drug Availability?

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice



Drug Availability?

**Rabbit
Keeping
Penalty**
\$30,000max



STATE BORDER
QUEENSLAND

**VERY STEEP
DESCENT**



NEXT 1 km

USE LOW GEAR

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice



lumpectomy



Leg fracture repair

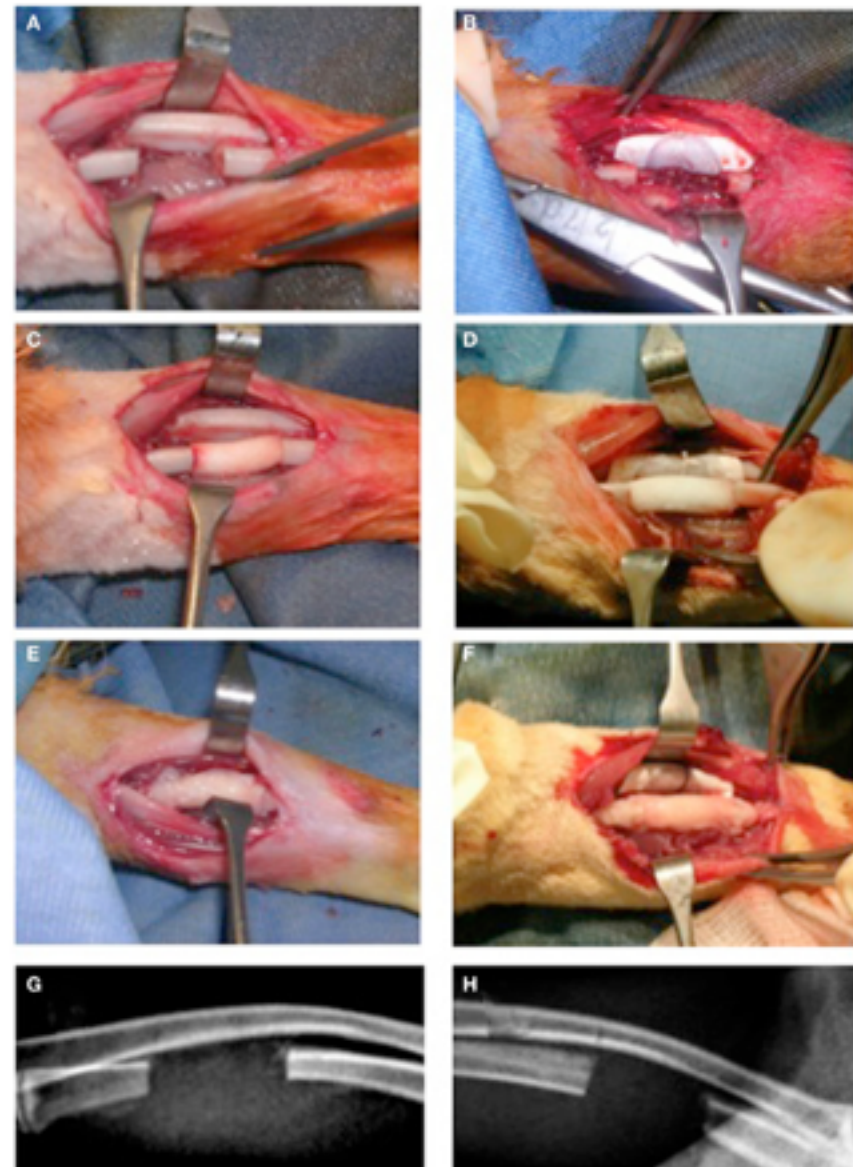
*Surgical procedures in private practice

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice



Tissue biopsy



v Orthopaedic surgery

*Surgical procedures in research setting

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice

- Meloxicam
- Ketoprofen
- Carprofen



**Non Steroidal Anti-inflammatory Drugs
(NSAIDs)**

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice

What are Anti-inflammatories?

- Drugs that reduce inflammation
- Can also be analgesic (not always)
- Important contra-indications
 - NSAIDs
 - Corticosteroids
 - Use in scientific research?

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice

- Pre-operative use risky
- If GA ok, use post-operatively, but if concern over prolonged hypotension, then postpone use till next day
- Avoid concurrent use of corticosteroids
- Avoid in renal insufficiency, dehydrated, hypotensive etc

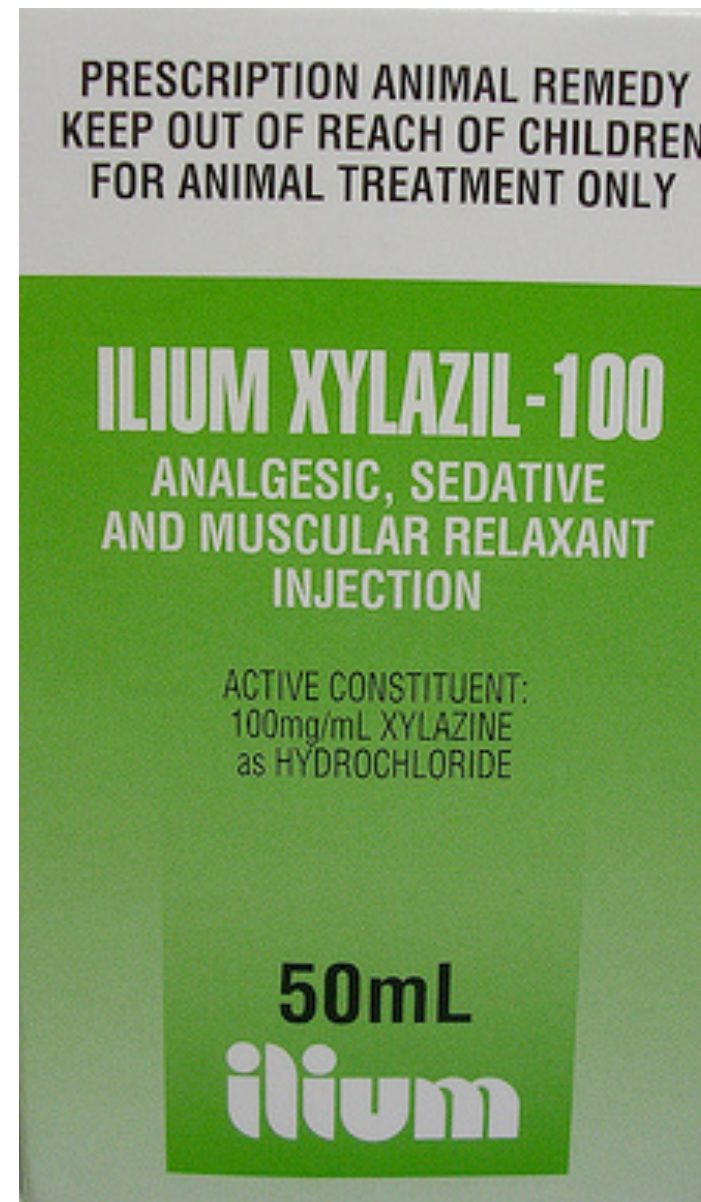


NSAIDs

Some Contraindications

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice

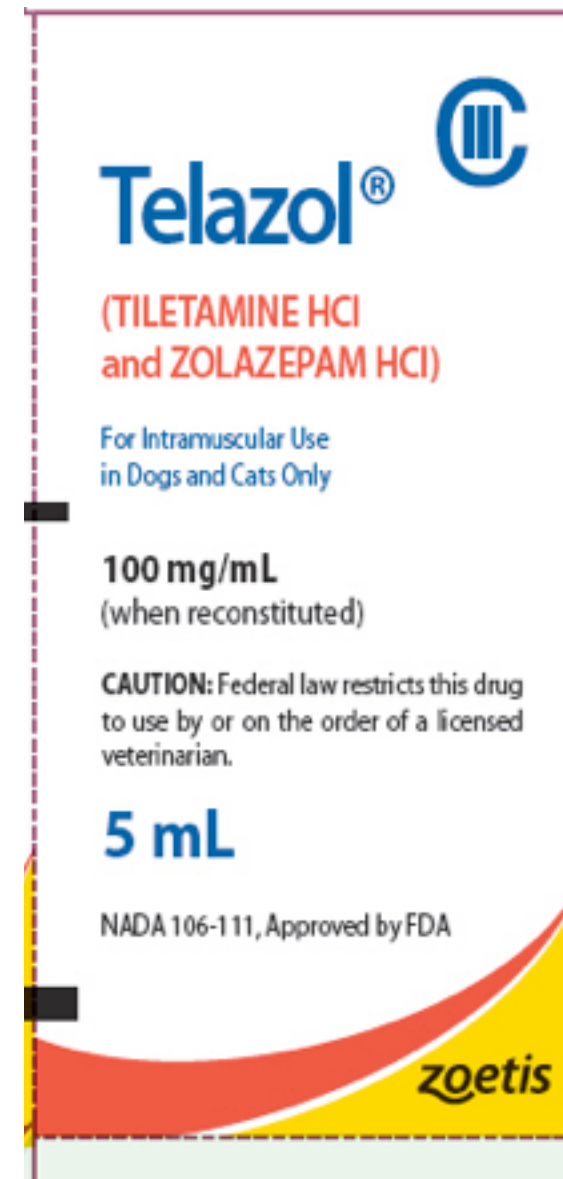


alpha-2 adrenergic agonists

Some Contraindications

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice



Tiletamine/Zolazepam combinations

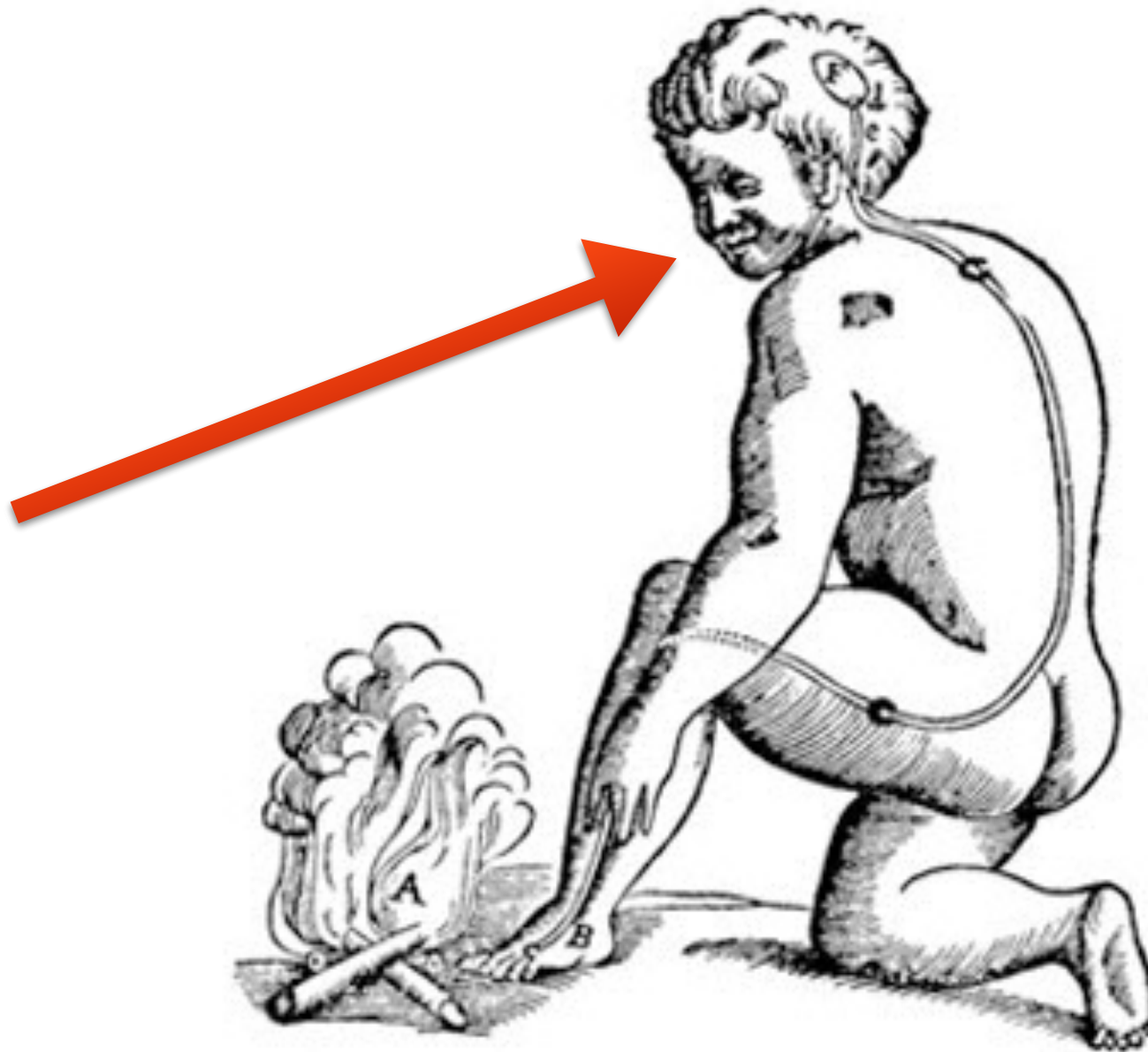
Rabbits: **Renal tubular necrosis***

Some Contraindications

*Brammer DW, et al. 1991. Anesthetic and nephrotoxic effects of Telazol in New Zealand white rabbits. *Lab An Sc.* 41(5):432-5.

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice



Descartes 1600s

Methods not well established

Anaesthesia/Analgesia in Rabbits & Rodents

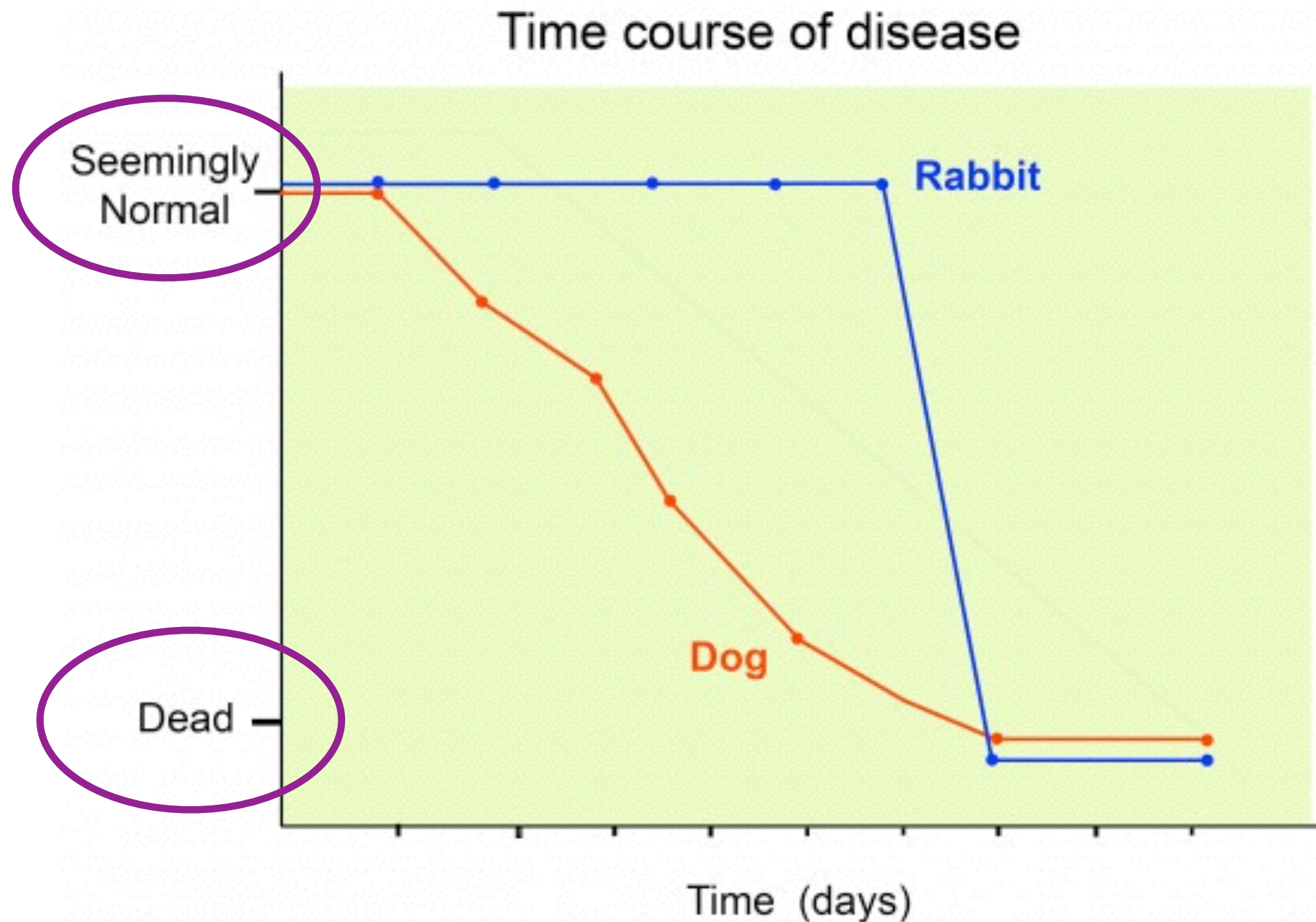
Factors affecting analgesic choice



Prey species - 'Mask' disease
Expressing v Perceiving

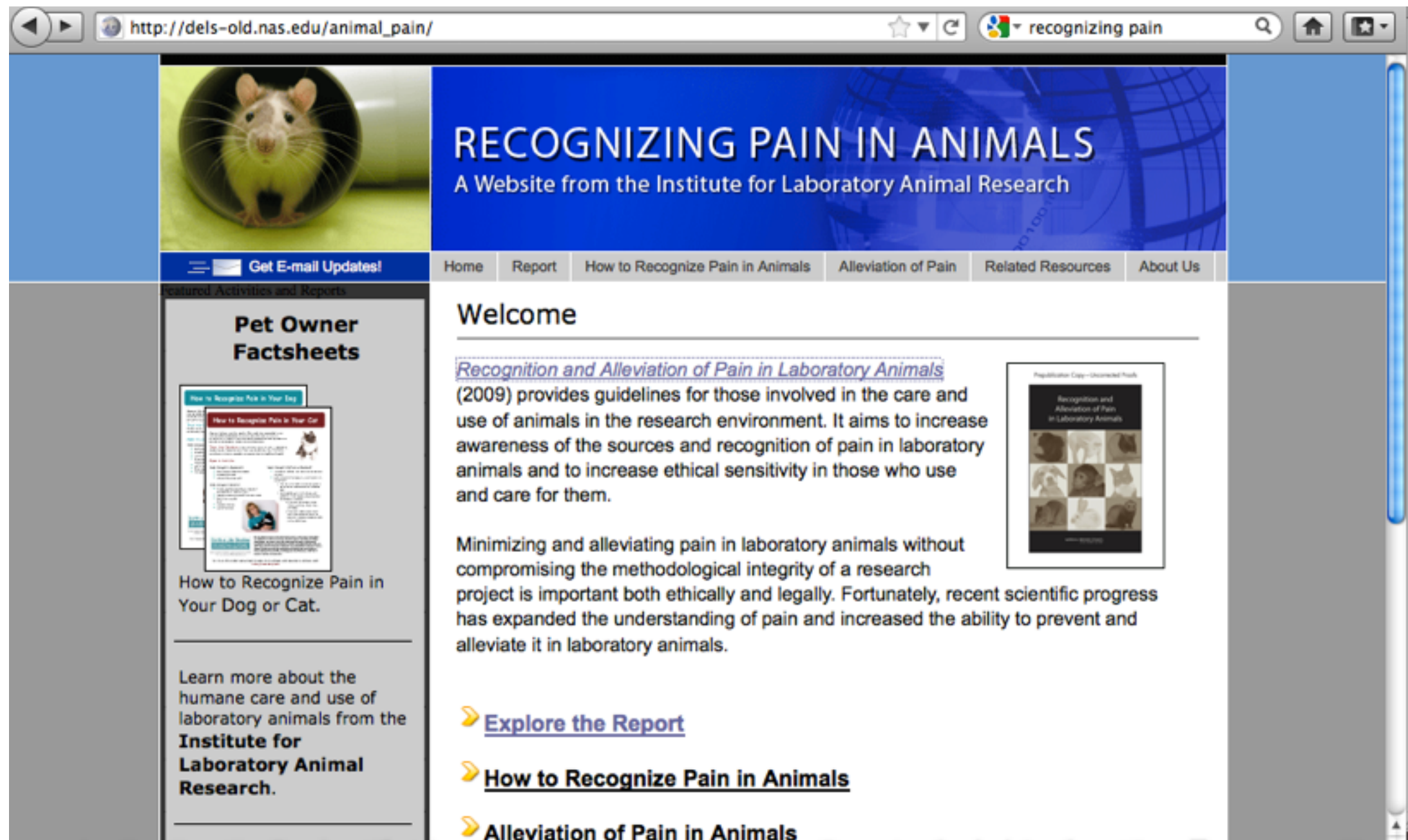
Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice



Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice



http://dels-old.nas.edu/animal_pain/index.shtml

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice



REPORT IN BRIEF

Recognition and Alleviation of Pain in Laboratory Animals

Minimizing and alleviating pain in laboratory animals without compromising the methodological integrity of a research project is important both ethically and legally. Fortunately, recent scientific progress has expanded the understanding of pain and increased the ability to prevent and alleviate it in laboratory animals. This report updates 1992 National Research Council guidelines for those involved in the care and use of animals in the research environment. It aims to increase awareness of the sources and recognition of pain in laboratory animals and to increase ethical sensitivity in those who use and care for them.

Many scientific advances in biomedical research would not be possible without the use of laboratory animals. Scientists rely on animals as one component of research to understand, treat, and cure diseases that plague both humans and the animals themselves. In most situations, laboratory animals need not experience pain. The alleviation and prevention of animal pain is both an ethical and moral imperative; minimizing animal pain is also scientifically and practically beneficial. For



ACADEMIES



pain_in_animals...



2



3



4

http://dels-old.nas.edu/animal_pain/index.shtml

Anaesthesia/Analgesia in Rabbits & Rodents

Factors affecting analgesic choice

RECOGNIZING PAIN IN ANIMALS
A Website from the Institute for Laboratory Animal Research

Home Report How to Recognize Pain in Animals Alleviation of Pain Related Resources About Us

Report

Recognition and Alleviation of Pain in Laboratory Animals
National Research Council, 2009

Pet Owner Factsheets

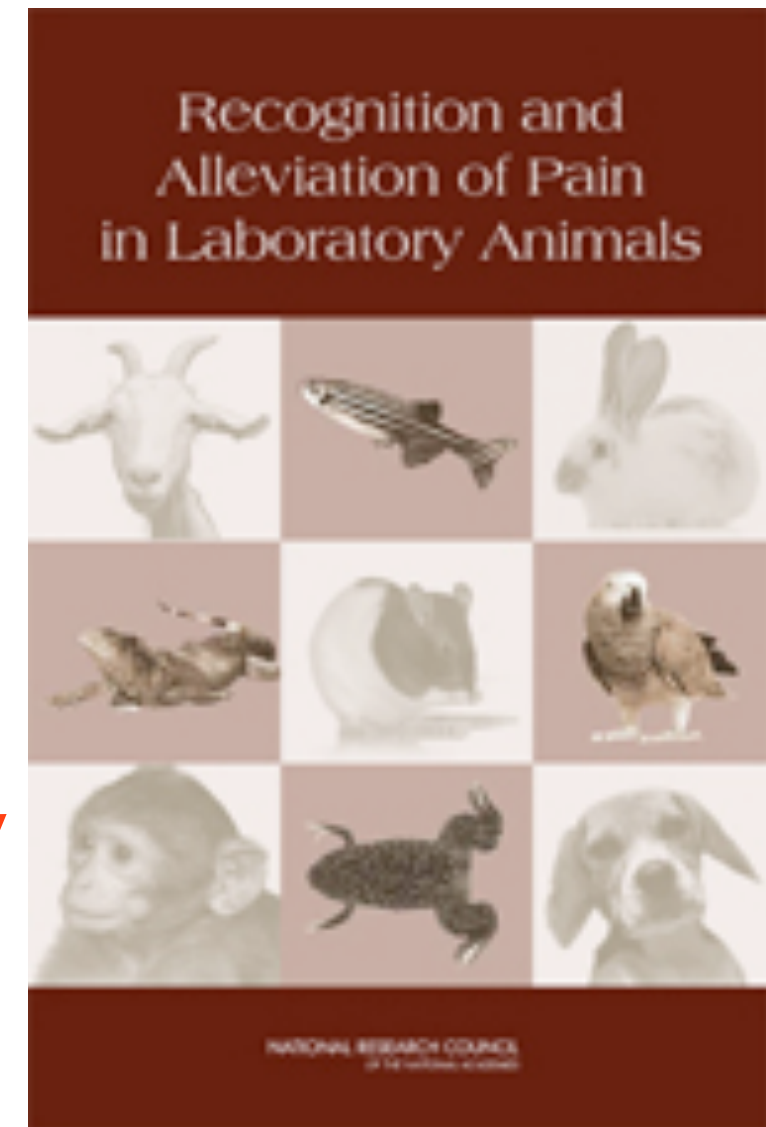
How to Recognize Pain in Your Dog or Cat.

Learn more about the humane care and use of laboratory animals from the **Institute for Laboratory Animal Research**

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http://dels-old.nas.edu/animal_pain/report.shtml

Anaesthesia/Analgesia in Rabbits & Rodents

Recognising Pain

Covered in next presentation

Anaesthesia/Analgesia in Rabbits & Rodents

Multimodal Analgesia

Pre-emptive analgesia

...is the idea that postoperative pain may be significantly attenuated using local anesthetics, opioids, or other agents as a supplement to anesthesia prior to surgical incision...

Niv & Devor 1996; *Curr Rev Pain*

Anaesthesia/Analgesia in Rabbits & Rodents

Multimodal Analgesia

Pre-emptive analgesia

- ↓ GA level required
- ↓ Post-op analgesia required
- ↑ Analgesia with ↓ side-effects
- ↓ Anxiety

Anaesthesia/Analgesia in Rabbits & Rodents

Multimodal Analgesia

Pre-emptive analgesia: Premedication

- ↓ Anxiety/fear
- ↑ Ability to restrain
- ↓ Dose of drugs
- ↓ Pain and 'wind-up' phenomenon
- Improve induction, maintenance, recovery
- ↓ Salival/bronchial secretions
- Block vasovagal reflex

Multimodal Analgesia

Inhibit Perception

- Anesthetics
- Opioids
- α_2 -agonists
- Benzodiazepines
- Phenothiazines

Modulation of Spinal Pathways

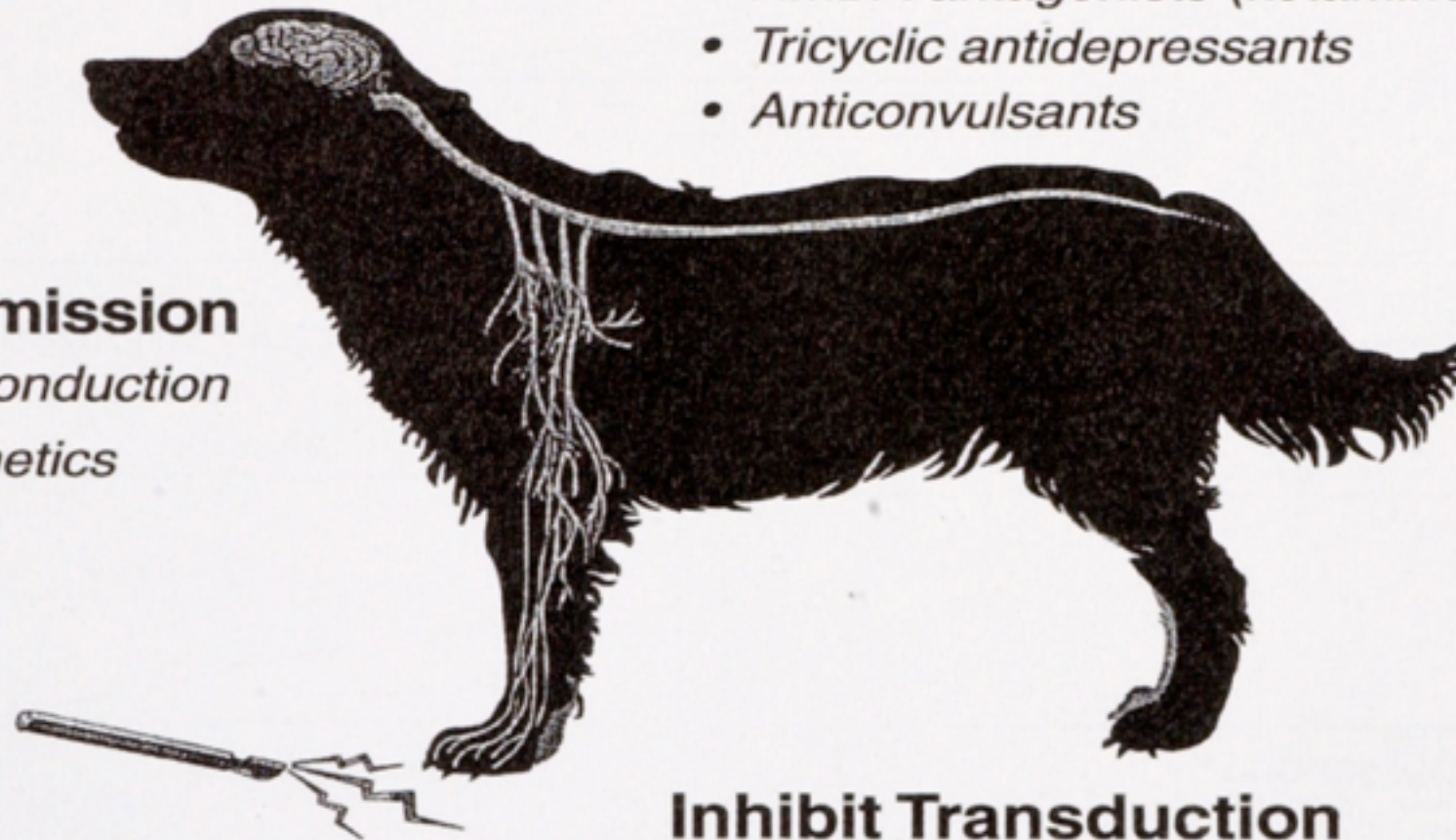
Inhibit central sensitization

- Local anesthetics
- Opioids or α_2 -agonists
- NSAIDs
- NMDA antagonists (ketamine)
- Tricyclic antidepressants
- Anticonvulsants

Inhibit Transmission

Inhibit impulse conduction

- Local anesthetics
- α_2 -agonists



Inhibit Transduction

Inhibit peripheral sensitization of nociceptors

- NSAIDs
- Opioids
- Local anesthetics
- Corticosteroids

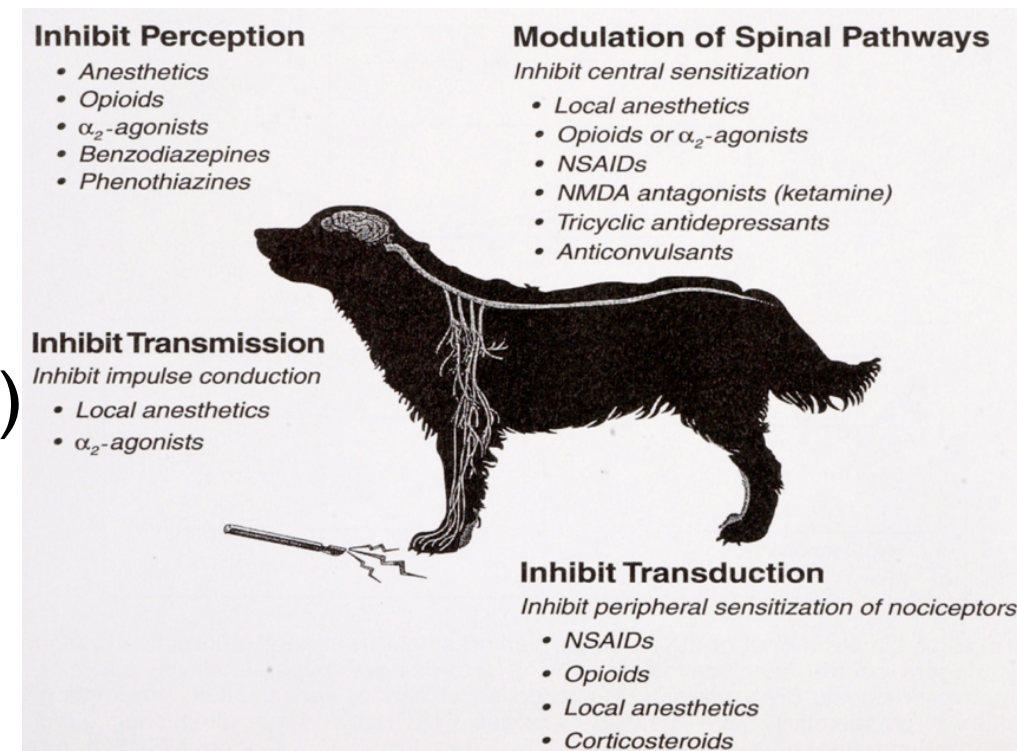
Analgesia in Rabbits & Rodents

Multimodal Analgesia

Aim = To decrease or inhibit nociception at different levels

- Transduction (LAs, NSAIDs)
- Transmission (LAs, opioids, α_2 A)
- Modulation (LAs, opioids, α_2 A, NMDAA)
- Projection (Opioids, α_2 A, NMDAA)
- Perception (Opioids, α_2 A)

(Gaseous GA, Benzodiazepines?, Phenothiazines?)





Handling Money May Alleviate Pain

Perception?

Zhou X, et al. 2009. The Symbolic Power of Money. Reminders of Money Alter Social Distress and Physical Pain. *Psych Sc.* 20(6)700-706

Anaesthesia/Analgesia in Rabbits & Rodents

Analgesic Classes



Opioids

Buprenorphine, Butorphanol, Fentanyl, Hydromorphone, Methadone, Morphine, Oxymorphone, Tramadol

Anaesthesia/Analgesia in Rabbits & Rodents

Analgesic Classes



Opioids

Buprenorphine, Butorphanol, Fentanyl, Hydromorphone, Methadone, Morphine, Oxymorphone, Tramadol

Anaesthesia/Analgesia in Rabbits & Rodents

Analgesic Classes



NSAIDs

Carprofen, Ketoprofen, Meloxicam

Anaesthesia/Analgesia in Rabbits & Rodents

Analgesic Classes



Local Anaesthetics (LAs)

Lignocaine, Bupivacaine, Ropivacaine?

Anaesthesia/Analgesia in Rabbits & Rodents

Analgesic Classes



alpha-2 adrenergic agonists (a2A)
Medetomidine, Xylazine

Anaesthesia/Analgesia in Rabbits & Rodents

Analgesic Classes



NMDA antagonists (NMDAA)
Ketamine, Tiletamine, (Methadone)

Anaesthesia/Analgesia in Rabbits & Rodents

Multimodal Analgesia

Perioperative Analgesic Regimen

- Premedicate

Opioid +/- Benzodiazepine +/- NMDAA

- Intra-op (Pre-op)

Opioid +/- LA +/- NMDAA +/- α 2A

- Post-op

Opioid +/- LA +/- NMDAA +/- α 2A +/- NSAID

Anaesthesia/Analgesia in Rabbits & Rodents

Multimodal Analgesia

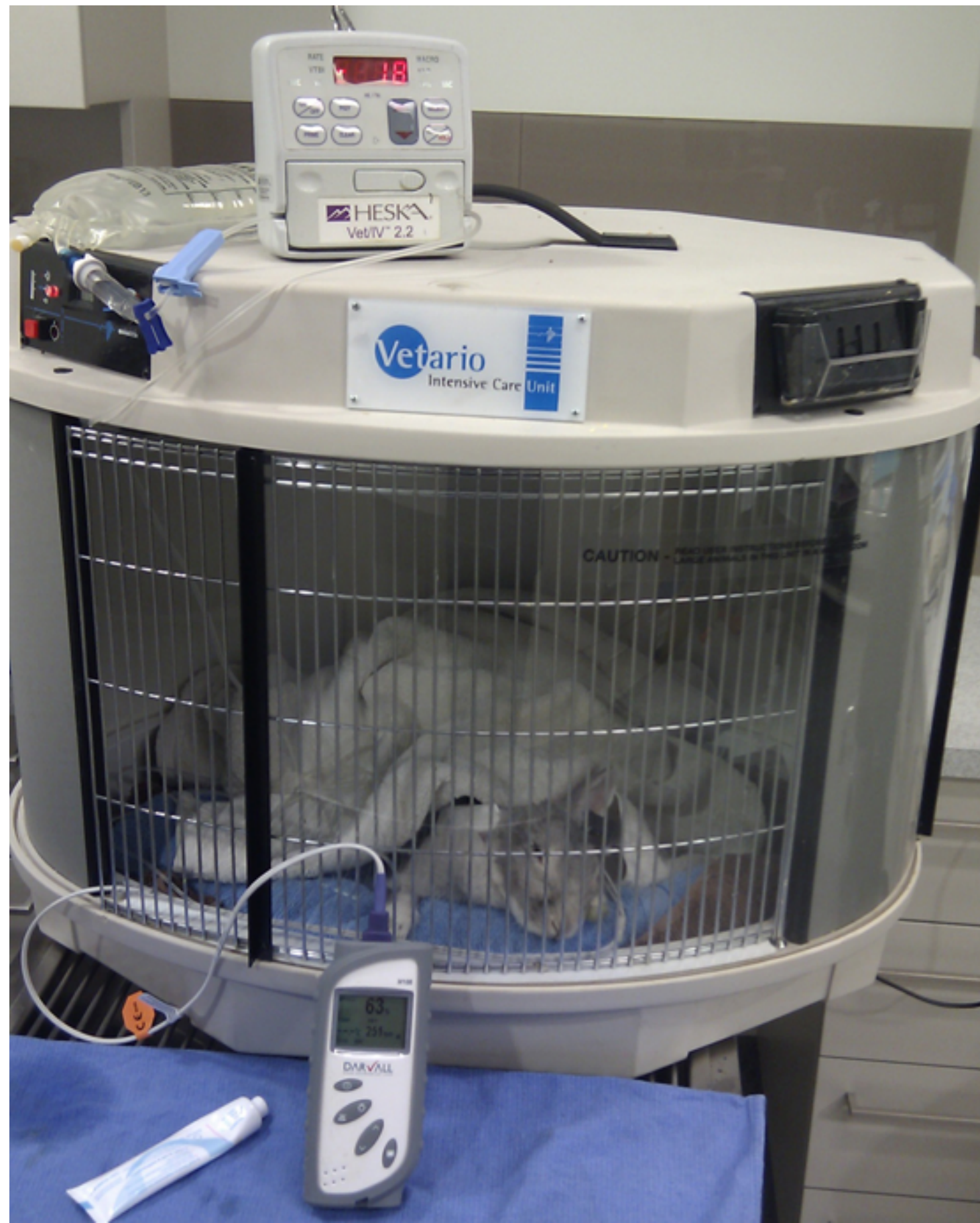


Other Factors - Intra-op Warmth!

Anaesthesia/Analgesia in Rabbits & Rodents

Multimodal Analgesia

Warmth - Post GA



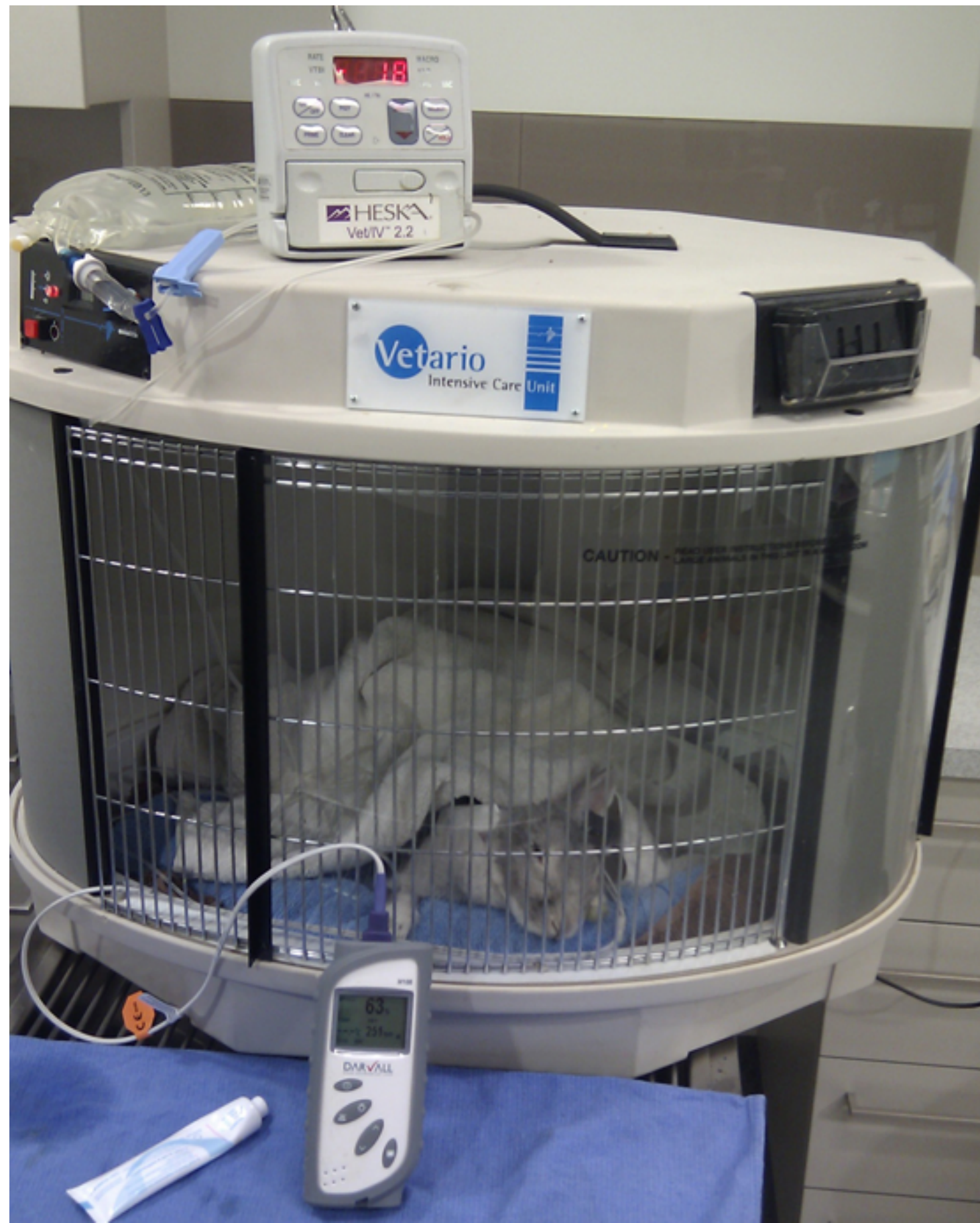
Anaesthesia/Analgesia in Rabbits & Rodents

Multimodal Analgesia

Warmth - Post GA

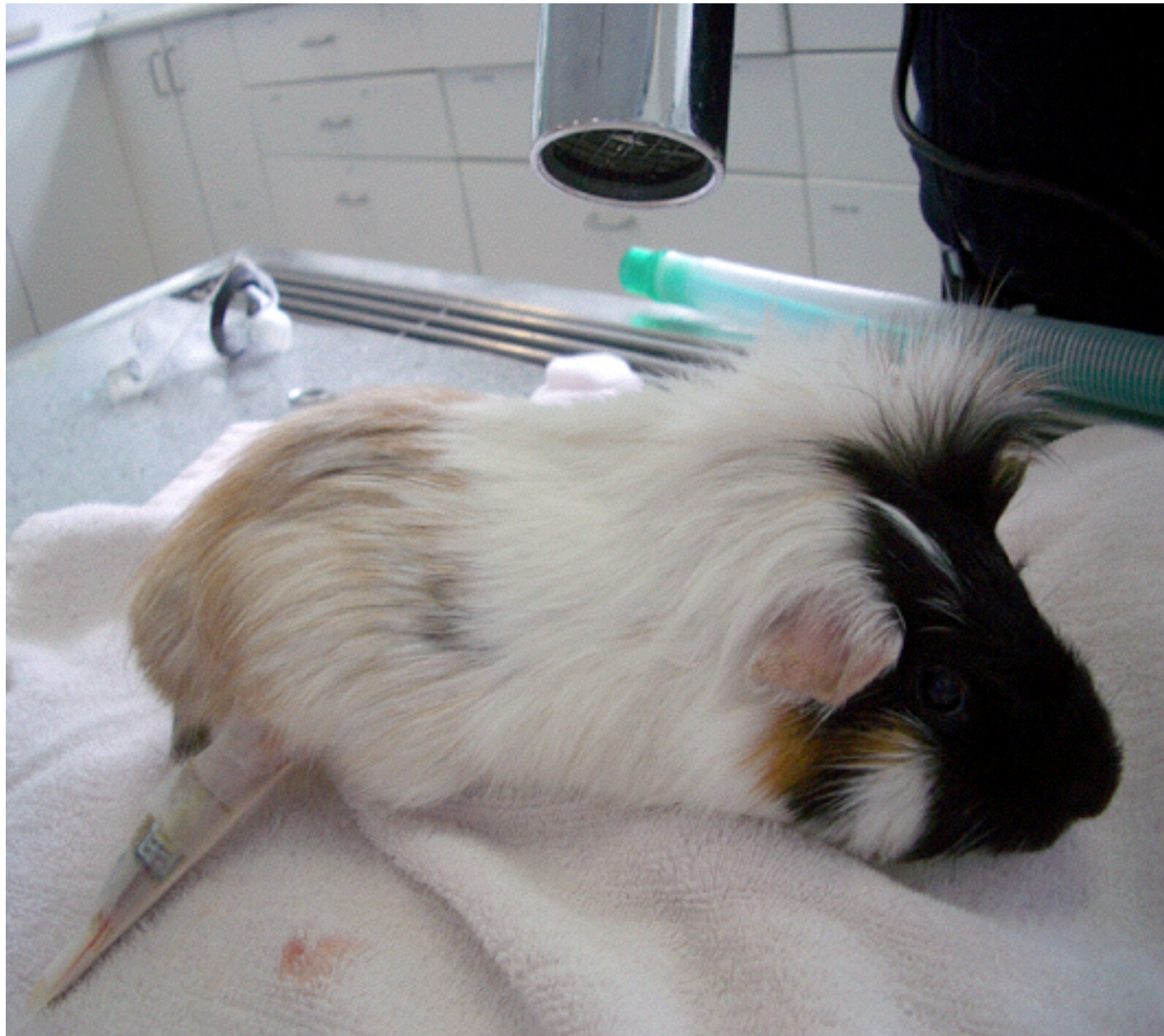
Critical Body
Temperature
= 36.6°C

SERV



Anaesthesia/Analgesia in Rabbits & Rodents

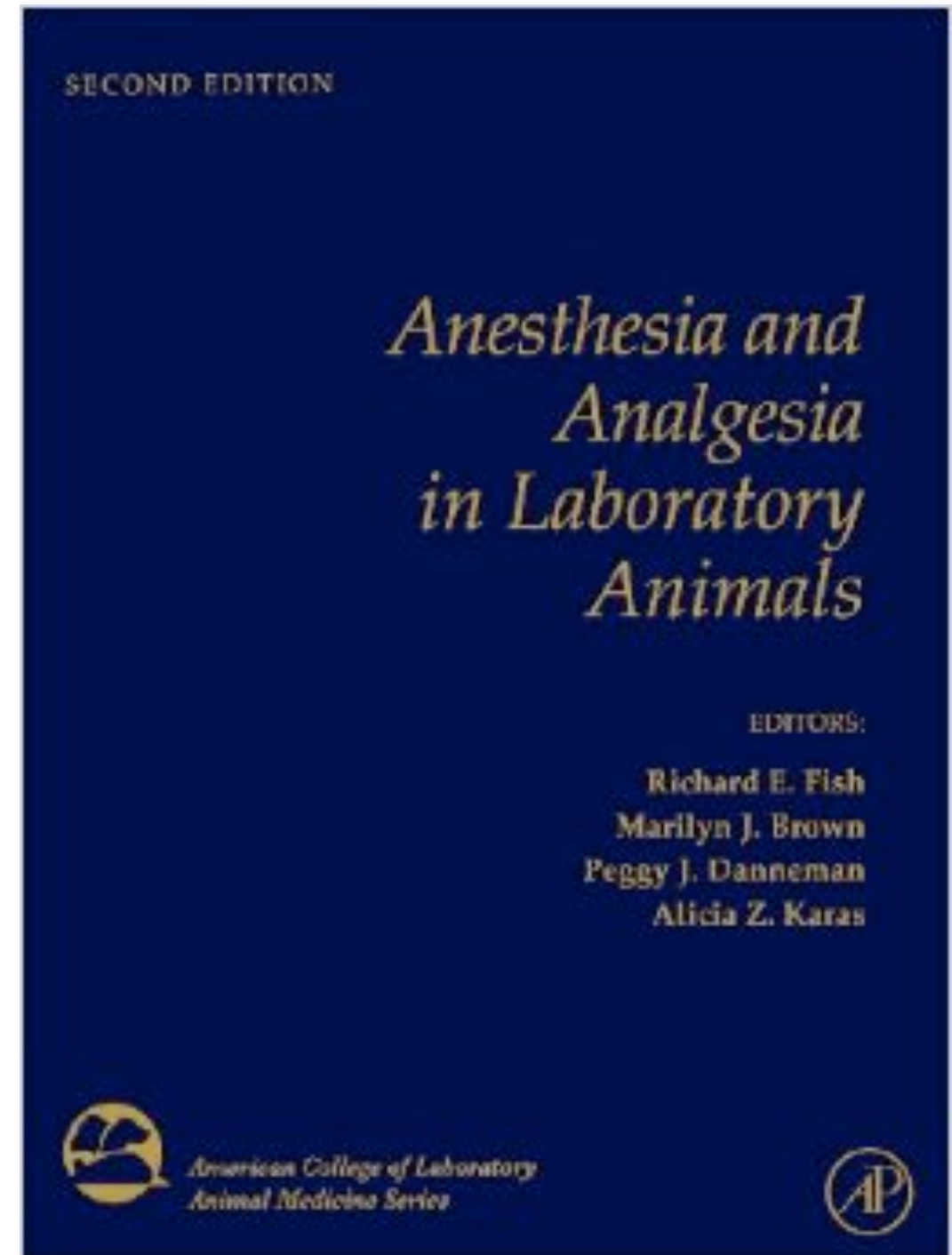
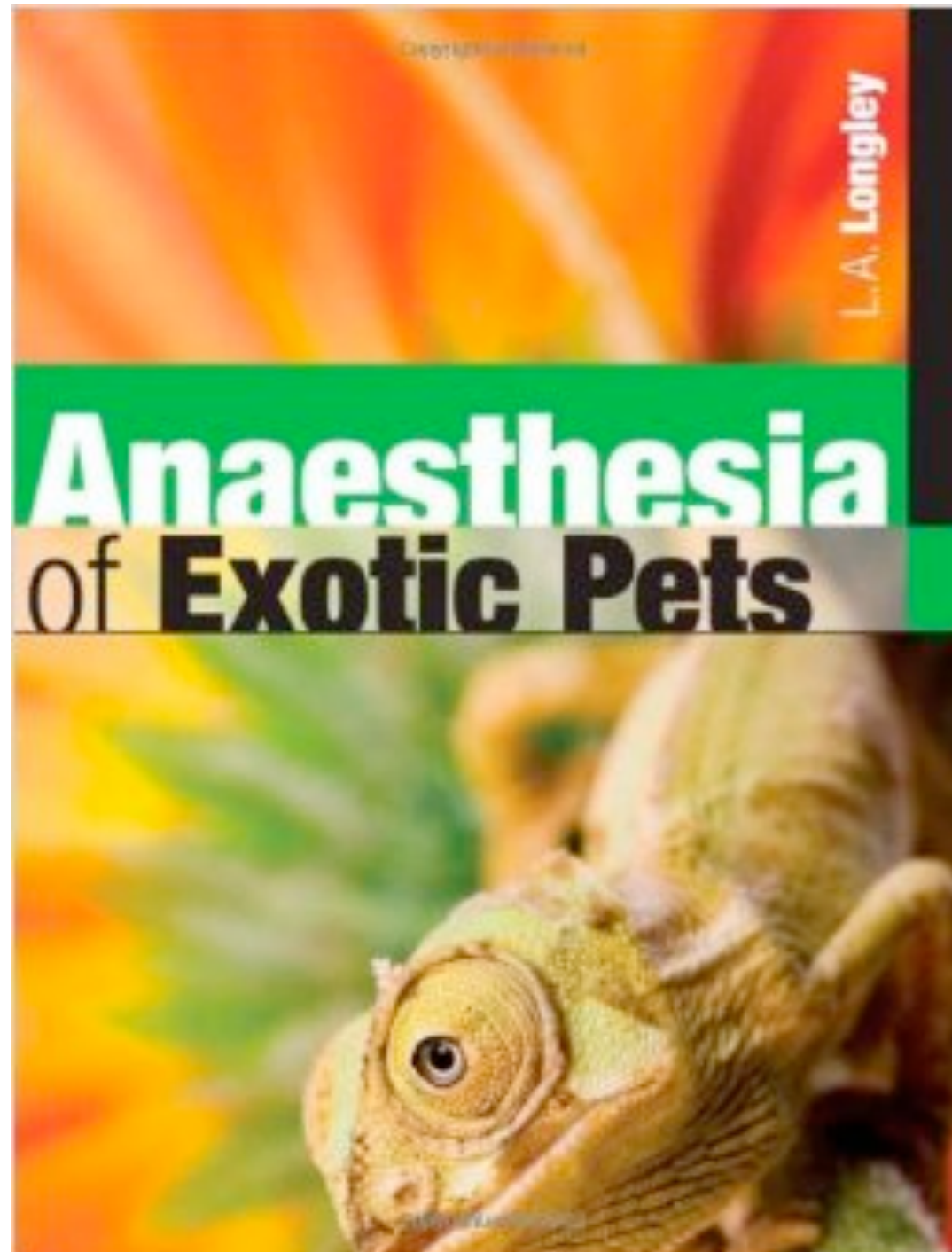
Multimodal Analgesia



Warmth - Post GA

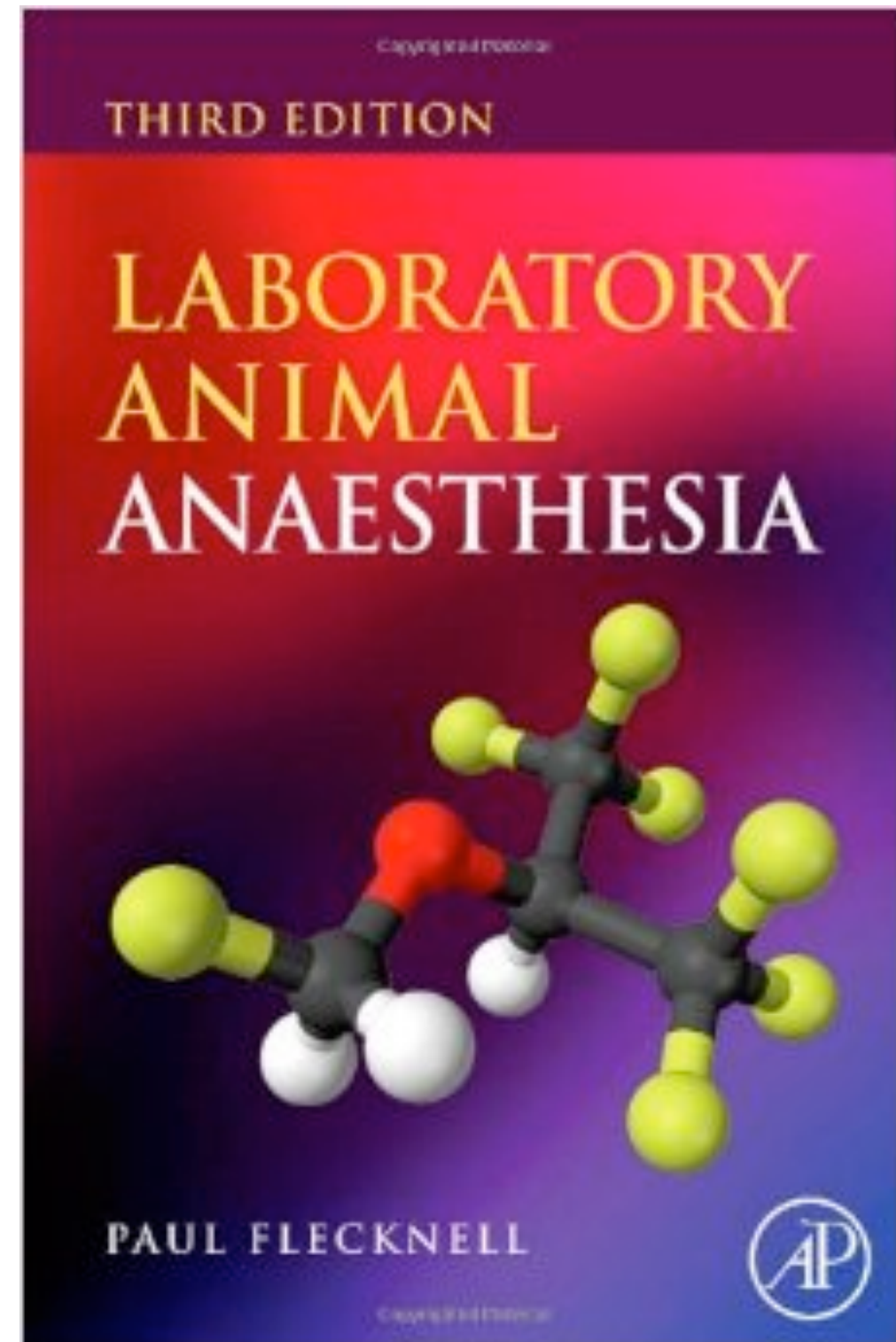
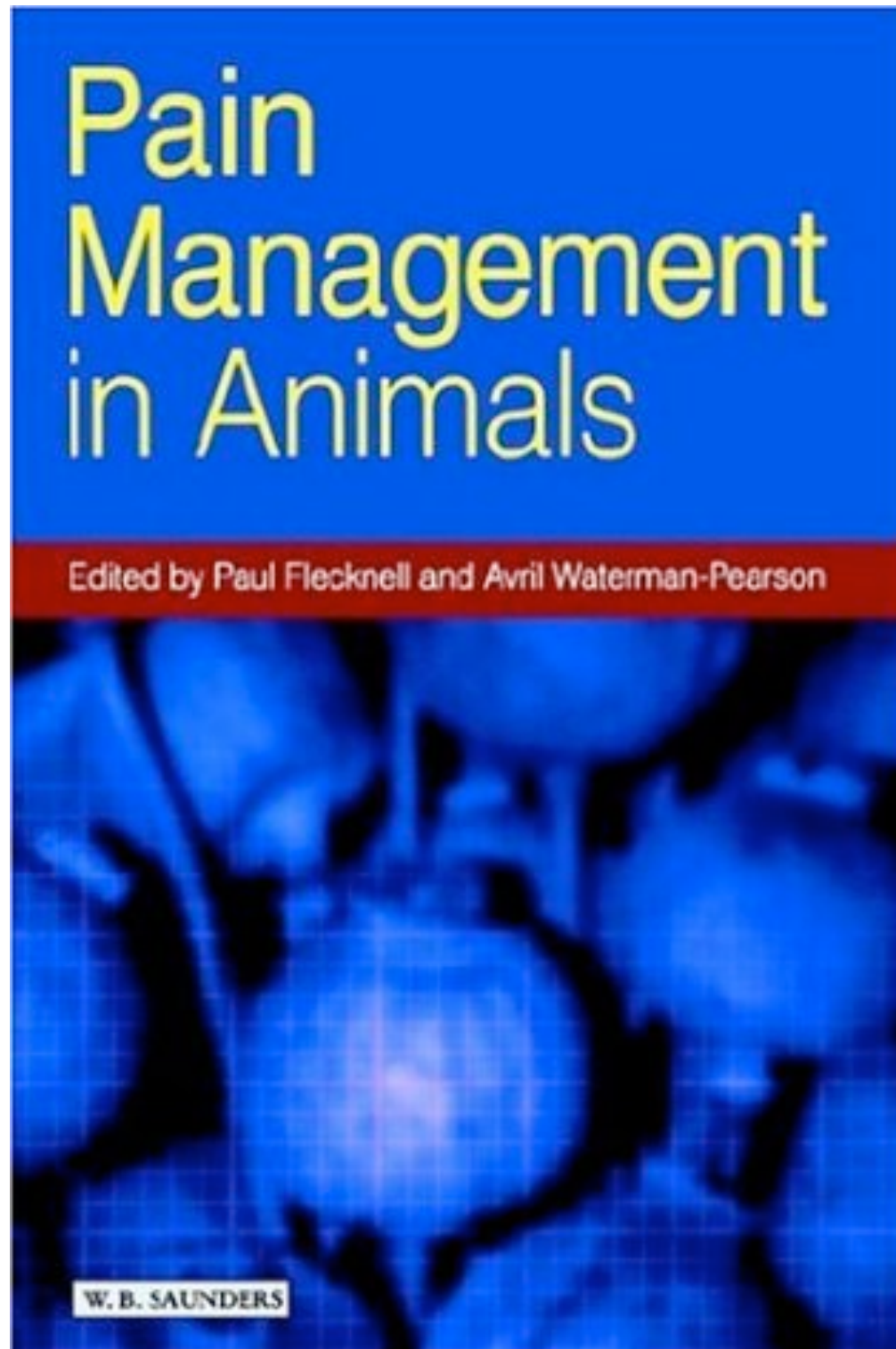
Anaesthesia/Analgesia in Rabbits & Rodents

Textbooks



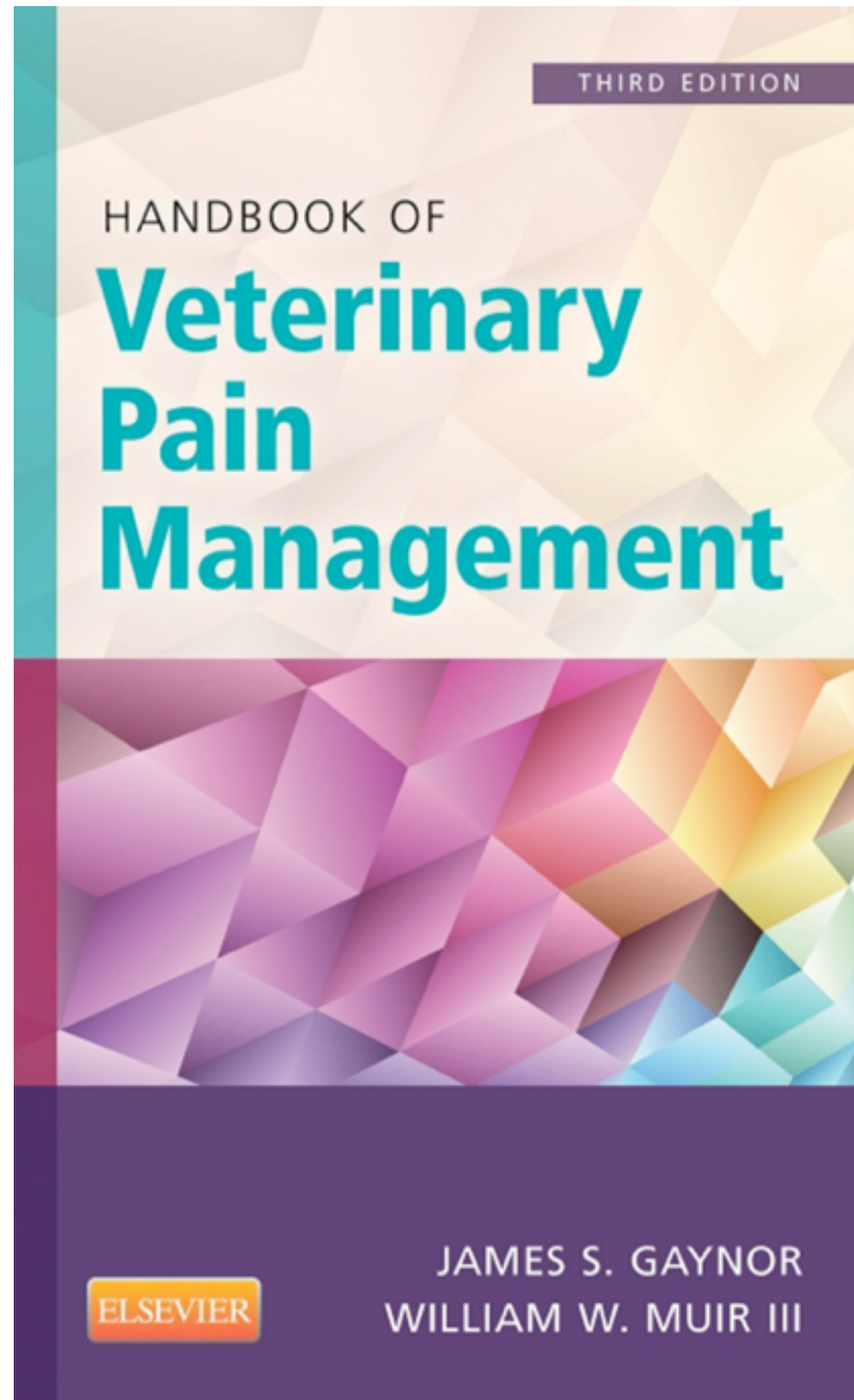
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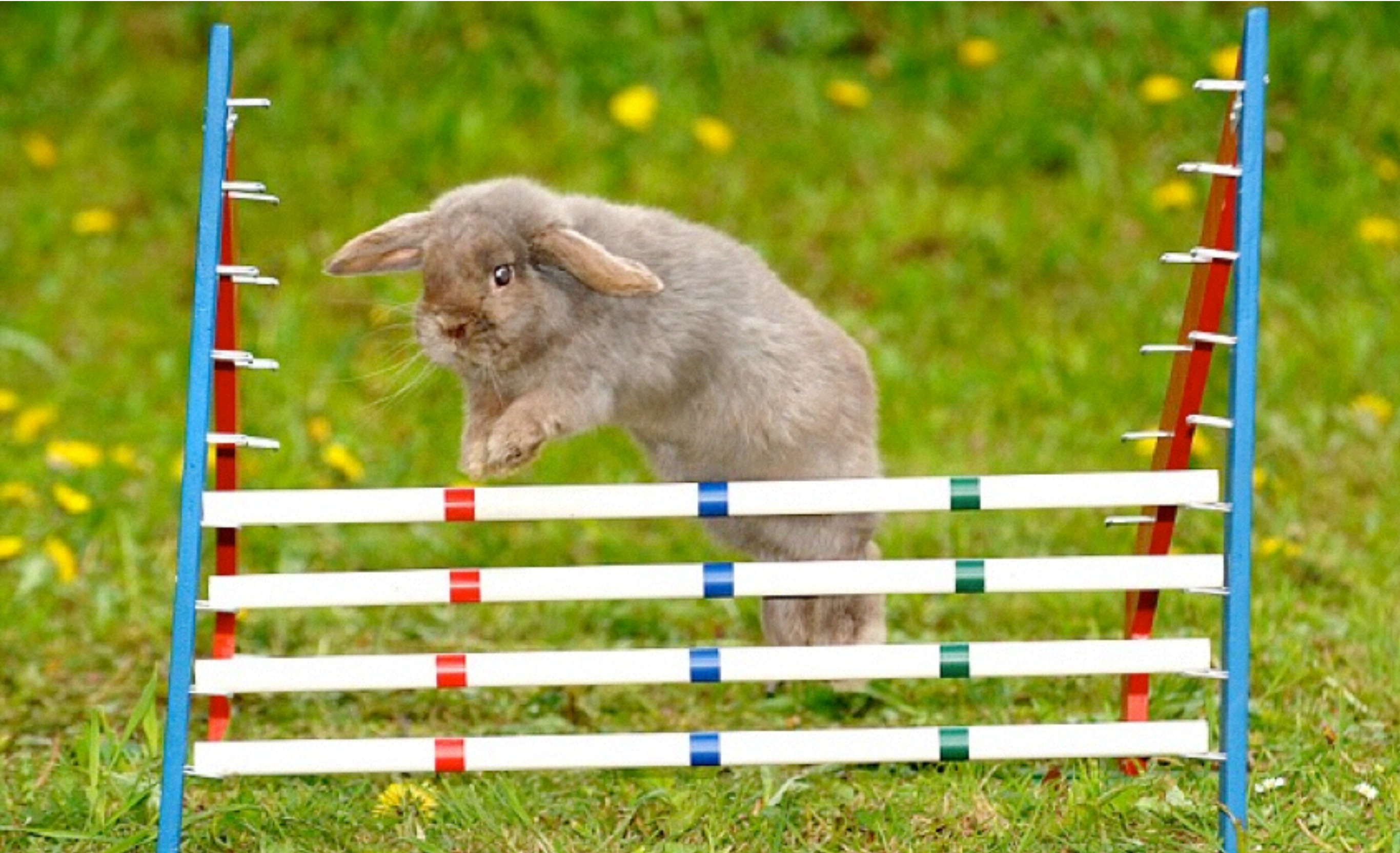
Textbooks



Anaesthesia/Analgesia in Rabbits & Rodents

Textbooks





Thank You!