# Considering the 3Rs of Alternatives in Research

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U.S. Department of Agriculture

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USDA ARS National Agricultural Library

# Objectives

- List the information requirements of the Animal Welfare Act.
- Define the 3 Rs of Alternatives.
- Become familiar with databases and other resources helpful in searching for alternatives.
- Design and run a search for alternatives.

# Pepper

In the summer of 1965, a female Dalmatian was stolen from the Lakavage family in Pennsylvania.

Her story changed America.

Seven days after Pepper's death, Rep. Joe Resnick introduced a pet theft bill on the House floor.

Pepper's journey in the summer of 1965 helped start a national media sensation and a broad panic over the theft of pets for biomedical research. Her death on an operating table in the Bronx would help animal welfare advocates break a long-standing stalemate in Congress and push through the most significant animal-protection bill in American history.

http://www.slate.com/id/2239551/

# Concentration Camps for Dogs

## THE GRISLY EVIDENCE

## BRINGS 29 CHARGES OF CRUELTY

On a bright but cold morning, the raiding party of Maryland State Police and Humane Society agents swooped into Lester W. Brown's place in White Hall, Md., not far from Baltimore. Police and agents began moving about the cluttered property that was piled with boxes and junked cars and functioning as a concentration camp for dogs. One officer began a notebook of observations: "Indescribably filthy conditions . . . inhumane environment . . . dogs chained to small boxes, many too small to hold them . . . common framed pens covered with chicken wire . . . dogs have to lie in their own organic waste . . . far too many dogs to meet even the minimum standards of being humane or sanitary."

The raid was at the behest of the Humane Society of the United States, which, in its constant surveillance of places like Brown's around the country, had sent one of its agents to check conditions at Brown's twice within the past year. The agent posed as a dog buyer and got enough evidence to swear out the search warrant used in the raid.

The raiders heard dogs barking, but only a few were making the noise. Many of the dogs were able only to sit or lie down, immobilized by the cold, by sickness and disease and by inhumane treatment for how long nobody knows.

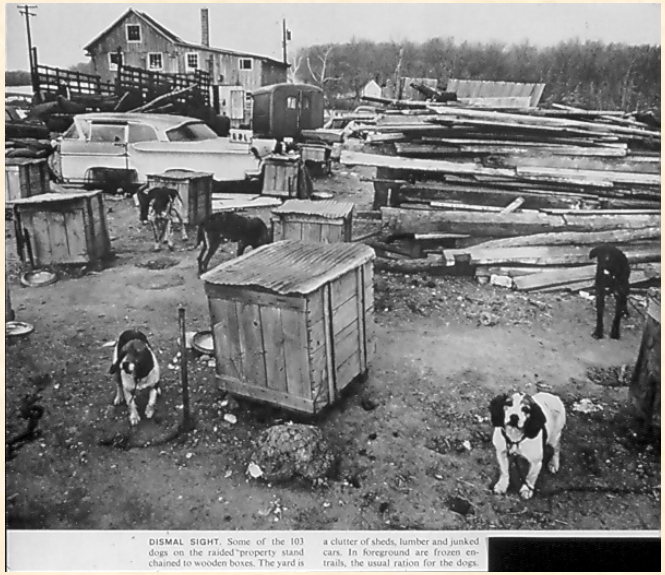
On Brown's back porch the police found 15 chicken crates piled in disarray. In the midst was a bucket of dirty water and an old galvanized tub partially filled with food that defied description but seemed to consist of dried bread and meal of some kind. Three of the crates were jammed full of pigeons; others contained raccoons, skunks, cats, a ground squirrel and a passel of puppies. In one crate were two large dogs that could neither stand up nor move because the crate was too small. When the dogs were removed and set on the ground, neither could walk.

Most of the state policemen who took part in the raid were hardened to almost anything from years of experience, but they spoke among themselves in terms of personal outrage, especially those who had pets of their own at home. The veterinarian who came along to identify sick dogs was infuriated by what he saw: a scrawny beagle clawing and chewing at one of the piles of frozen entrails that lay everywhere in Brown's yard. Another dog licking desperately at a dish of water that was frozen solid. Then Frank McMahon, Humane Society field director, lifted the burlap covering of a dog box and exclaimed, "Deader than hell!" Inside was a large hound frozen to death (*above*). They had to tear the box apart to get the dog out.

Soon two trucks from the Baltimore County Humane Society pulled up and began loading the 28 dogs that were most obviously sick. These were taken to the animal shelter. Left behind were some 75 dogs, their fate still up to Mr. Brown. The 71-year-old dog dealer was charged with 28 counts of cruelty, one for each of the sick dogs. And there was a 29th charge —for the dog that froze to death.

**ADED FOR SHELTER.** One of sick dogs rescued in raid is hoist- by Mrs. Helen Crews of the Bal- ore County Humane Society into ruck for trip to animal shelter.

**WARNING TO THIEVES.** Angered by the disappearances of their family pets in Clarke County, Va., Mrs. William Mitchell and her neighbors put up signs to discourage thieves.



**DISMAL SIGHT.** Some of the 103 dogs on the raided property stand chained to wooden boxes. The yard is a clutter of sheds, lumber and junked cars. In foreground are frozen entrails, the usual ration for the dogs.

# August 24,1966

## Laboratory Animal Welfare Act signed into law

Amended in 1970, 1976, 1985, 1990, 2002, 2007, 2008

http://www.nal.usda.gov/awic/pubs/AWA2007/awa.shtml

# Public Concern Continues...

- 1982 - The Case of the Silver Spring Monkeys
- 1983 - University of Pennsylvania
  Head Injury Clinic

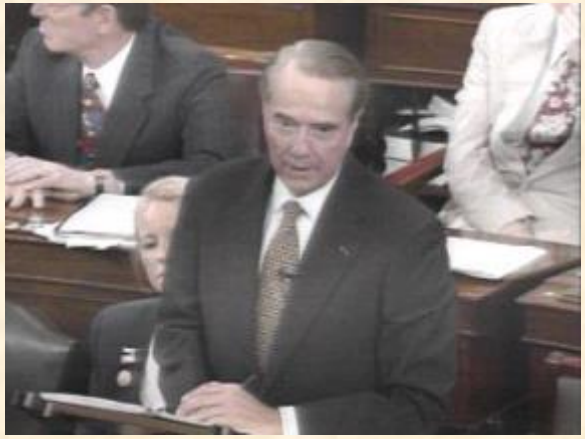
***These two events caught the attention of the public and Congress and set the stage for more far-reaching regulations.***

# Food Security Act of 1985

## Subtitle F, Animal Welfare, Public Law 99-198

## *Improved Standards for Laboratory Animals Act*

"…the farm bill contains legislation dealing with the humane treatment of animals. The main thrust of the bill is to minimize pain and distress suffered by animals used for experiments and tests. In so doing, biomedical research will gain in accuracy and humanity. We owe much to laboratory animals and that debt can best be repaid by good treatment and keeping painful experiments to a minimum."



**Sen. R. Dole**
***Congressional Record***
**Senate**
**17 December 1985**

# Food Security Act of 1985

## Subtitle F, Animal Welfare, Public Law 99-198

## *Improved Standards for Laboratory Animals Act*

- Clarifies humane care to include specific criteria such as sanitation, ventilation, and housing.
- Directs the Secretary of Agriculture to establish regulations for
  - exercise for dogs and
  - a physical environment adequate to promote the psychological well-being of primates.
- Specifies that animal pain and distress must be minimized (veterinary care, anesthesia, analgesia, tranquilizers, and euthanasia).

# Food Security Act of 1985

## Subtitle F, Animal Welfare, Public Law 99-198

## *Improved Standards for Laboratory Animals Act*

- Specifies that principal investigators must consider alternatives to any procedure likely to cause pain or distress.
- Establishes the Institutional Animal Care and Use Committee (IACUC).
- Explains penalties for the release of trade secrets.
- Establishes an information service at the National Agricultural Library.
- Annual inspections of research facilities

# AWA Defines Service at NAL
## (7 U.S.C. 2142, Sec. 13, Subsection e)

The Secretary shall establish an information service at the National Agricultural Library. Such service shall, in cooperation with the National Library of Medicine, provide information--

(1) pertinent to employee training;

(2) which could prevent unintended duplication of animal experimentation as determined by the needs of the research facility; and

(3) on improved methods of animal experimentation which could--

**(A) reduce or replace animal use; and**

**(B) minimize pain and distress to animals, such as anesthetic and analgesic procedures.**

# Farm Security and Rural Investment Act of 2002 (*Farm Bill*)
## Public Law 107-101

- Modifies the definition of animals to exclude rats, mice and birds bred for use in research.
- Makes it illegal to knowingly sponsor or exhibit an animal in a fighting venture, if any animal was moved in interstate or foreign commerce and increases fines.

# Code of Federal Regulations
## Title 9, Chapter I, Subchapter A, Animal Welfare

- Specifies how to comply with the Animal Welfare Act and its amendments.
  - Definitions: "Animal" excludes *Rattus*, *Mus*, and birds bred and raised for use in research.
  - Regulations: Specific requirements for facility licensing, veterinary care, records, stolen animals.
  - Standards: Facilities and operations, health and husbandry, transportation.
  - Rules of Practice: Scope, application, administrative procedures.

# Code of Federal Regulations
## Title 9, Chapter I, Subchapter A, Animal Welfare

Painful Procedure, Sec. 1.1

…as applied to any animal means any procedure that would reasonably be expected to cause more than slight or momentary pain or distress in a human being to which that procedure was applied, that is pain in excess of that caused by injections or other minor procedures.

# Animal Care Policy #11
## Painful and Distressful Procedures: March 25, 2011

- Examples of procedures that may cause **more than momentary or slight pain** include, but are not limited to, the following:
  - **Surgery (survival or terminal):** considered a painful procedure in which pain is alleviated by anesthesia. Survival surgery may also require the use of peri-operative analgesia.
  - **Freund's Complete Adjuvant:** may cause a severe inflammatory reaction depending on the species and route of administration.
  - **Ocular or Dermal Toxicity Testing:** the dosing procedure itself is generally not painful but the reaction caused by the product being tested may cause pain.

- Examples of procedures that may cause **more than momentary or slight distress** include, but are not limited to, the following:
  - **Food and/or water deprivation or restriction** beyond that necessary for normal presurgical preparation.
  - **Noxious electrical shock or thermal stress** that is not immediately escapable.
  - **Paralysis or immobility** in a conscious animal.
  - **Forced exercise** (e.g., swimming or treadmill protocols).
  - **Infectious and inflammatory disease models.**

- Examples of procedures that may cause more than momentary or slight pain as well as distress would include:
  - **studies involving extensive irradiation**
  - **inhalation toxicity studies**
  - **tumor growth**

http://www.aphis.usda.gov/animal_welfare/downloads/policy/Policy%2011%20Final.pdf

# Information Requirements of the AWA 9 CFR 2.31 (d)

[The] IACUC shall determine that…

(ii) The principal investigator has considered alternatives to procedures that may cause more than momentary or slight pain or distress to the animals, and has provided a written narrative description of the methods and sources, e.g., the Animal Welfare Information Center, used to determine that alternatives were not available;

(iii) The principal investigator has provided written assurance that the activities do not unnecessarily duplicate previous experiments.

# Information Requirements of the AWA 9 CFR 2.31 (d)

[The] IACUC shall determine that…

(iv) Procedures that may cause more than momentary or slight pain or distress to the animals will:

(A) Be performed with appropriate sedatives, analgesics or anesthetics, unless withholding such agents is justified for scientific reason, in writing, by the principal investigator and will continue for only the necessary period;

# Information Requirements of the AWA 9 CFR 2.31 (d)

[The] IACUC shall determine that…

(x) No animal will be used in more than one major operative procedure from which it is allowed to recover unless:

(A) Justified for scientific reasons by the principal investigator in writing.

(B) Required as routine veterinary procedure.

(C) Approved by the Administrator of APHIS.

# Federal Register – Final Rules and Regulations

## Vol. 54 (168)
## August 31, 1989

"The principal investigator must provide a written narrative of the sources, such as biological abstracts, Index Medicus, the Current Research Information Service (CRIS), and the Animal Welfare Information Center that is operated by the National Agricultural Library. We believe that in fulfilling this requirement Committee members will discuss these efforts with the principal investigator in reviewing the proposed activity. We also believe that considerations of alternatives will be discussed during Committee meetings where proposed activities are presented for approval, and made part of the meeting minutes…"

# Animal Care Policy #12
## Written Narrative for Alternatives to Painful/Distressful Procedures: March 25, 2011

- "..APHIS continues to recommend a database search as the most effective and efficient method for demonstrating compliance with the requirement to consider alternatives to painful/distressful procedures."

- The database search narrative must, at a minimum, include
  - Names of the databases searched ("one database is seldom adequate")
  - Date the search was performed
  - Time period covered by the search
  - The search strategy (including scientifically relevant terminology) used.

http://www.aphis.usda.gov/animal_welfare/downloads/policy/Policy%2012%20Final.pdf

# Animal Care Policy #12

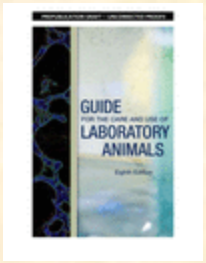
## Written Narrative for Alternatives to Painful/Distressful Procedures: March 25, 2011

"**Alternatives should be considered in the planning phase of the animal use proposal".** … "If a database search or other source identifies a bona fide alternative method (one that could be used to accomplish the goals of the animal use protocol), the IACUC may and should ask the PI to explain why an alternative that had been found was not used".

# Other Policies and Guidelines

- Public Health Service Policy on Humane Care and Use of Laboratory Animals

  http://grants1.nih.gov/grants/olaw/references/phspol.htm




- Guide for the Care and Use of Laboratory Animals

  http://www.nap.edu/catalog.php?record_id=12910

- Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching

  http://www.fass.org/page.asp?pageID=216

- AVMA Guidelines on Euthanasia (2013 Edition)

  https://www.avma.org/KB/Policies/Documents/euthanasia.pdf

# Federally Mandated IACUC Functions Under the AWA

- Review, at least once every six months, the research facility's program for humane care and use of animals, using title 9, chapter 1, subchapter A—Animal Welfare, as a basis for evaluation.

- Inspect, at least once every six months, all of the research facility's animal facilities, including animal study areas, using title 9, chapter 1, subchapter A—Animal Welfare as a basis for evaluation. Areas where animals are housed for more than 12 hours are defined as "study areas."

- Prepare reports of its evaluations (using CFR Title 9, chapter 1, A – AWR) and submit to the IO. …no member wishing to participate in any evaluation [can be] excluded. Reports must distinguish significant deficiencies from minor deficiencies and must contain a reasonable and specific plan and schedule with dates for correcting. Notify APHIS and Federal funding agencies if uncorrected by scheduled date.

- Review and investigate legitimate concerns involving the care and use of animals at the research facility resulting from public complaints and from reports of non-compliance received from facility personnel or employees.

# Federally Mandated IACUC Functions Under the AWA

- Make recommendations to the IO regarding any aspect of the research facility's animal program, facilities, or personnel training.
- Review and approve, require modifications in (to secure approval), or withhold approval of those components of proposed activities related to care and use of animals.
- Review and approve, require modifications in (to secure approval), or withhold approval of proposed significant changes regarding the care and use of animals in ongoing activities.
- Suspend an activity involving animals when necessary; take corrective action and report to funding agency and USDA.

# Federal Criteria for Granting IACUC Approval

| | |
|---|---|
| **Activities** | Must be in accord with USDA Regulations. |
| **Pain/Distress** | Must avoid/minimize discomfort/distress/pain. If pain/distress is caused, appropriate sedation, analgesia, or anesthesia will be used. Attending veterinarian must be involved in planning. Use of paralytics without anesthesia is prohibited. Animals with chronic/severe unrelievable pain will be painlessly euthanized. |
| **Surgery** | Must meet requirements for sterile surgery and pre/post operative care. Cannot use one animal for more than one major operative procedure from which it will recover, without meeting specified conditions. |
| **Euthanasia** | Must be consistent with USDA Regulations/AVMA recommendations. |

# Federal Criteria for Granting IACUC Approval

| | |
|---|---|
| **Housing/ Health** | The animals' living conditions will be appropriate for their species (see part 3 of the regulations) and contribute to their health and comfort. The housing, feeding, and nonmedical care of the animals will be directed by the attending veterinarian or other scientist trained and experienced in the proper care, handling, and use of the species being maintained or studied. Medical care for animals will be available and provided as necessary by a qualified veterinarian. |
| **Alternatives** | Must provide written narrative description of methods and sources used to determine that alternatives were not available. |
| **Animals** | A proposal…must contain the following: (1) Identification of the species and approximate number of animals to be used; (2) A rationale for involving animals, and for the appropriateness of the species and numbers of animals to be used… |
| **Duplication** | Must provide assurances that activities do not unnecessarily duplicate previous efforts |
| **Qualifications** | Personnel must be appropriately qualified for procedures and species. |
| **Deviations** | Must be justified for scientific reasons, in writing. |

# Required Contents for an Institutional Training Program

(1) Humane methods of animal maintenance and experimentation, including:
(i) The basic needs of each species of animal;
(ii) Proper handling and care for the various species of animals used by the facility.
(iii) Proper pre-procedural and post-procedural care of animals; and
(iv) Aseptic surgical methods and procedures.

(2) The concept, availability, and use of research or testing methods that limit the use of animals or minimize animal distress.

(3) Proper use of anesthetics, analgesics, and tranquilizers for any species of animals used by the facility.

(4) Methods whereby deficiencies in animal care and treatment are reported, including deficiencies in animal care and treatment reported by any employee of the facility. No facility employee, committee member, or laboratory personnel shall be discriminated against or be subject to any reprisal for reporting violations of any regulation or standards under the Act,

(5) Utilization of Services (e.g., National Agricultural Library, National Library of Medicine) available to provide information;
(i) On appropriate methods of animal care and use;
(ii) On alternatives to the use of live animals in research;
(iii) That could prevent unintended and unnecessary duplication of research involving animals; and
(iv) Regarding the intent and regulation of the Act.

# Alternatives and the 3Rs

# Definition of Alternatives

- **Russell and Burch (1959) –** *The Principles of Humane Experimental Technique*
  - **Full text available online at AltWeb:** http://altweb.jhsph.edu/pubs/books/humane_exp/het-toc

- **Development of the concept of the 3Rs:**
  - **Reduction**
  - **Refinement**
  - **Replacement**

# Alternatives
## The 3Rs of Russell and Burch

**Reduction -** Minimize the number of animals used.

**Refinement -** Employ techniques that reduce pain and distress.

**Replacement -** Substitute animal with nonanimal methods or lower organisms.

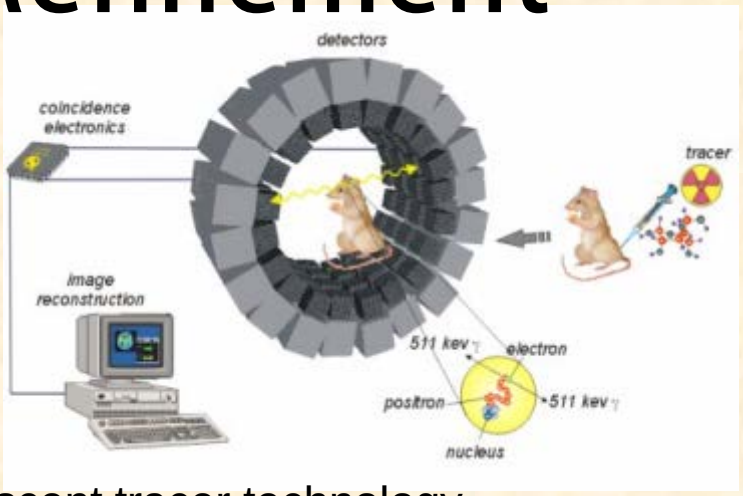
# Alternatives: *Reduction*

*The Principles of Humane Experimental Technique* (1959)

- **Quality literature search**
- **Appropriate statistical design**
- **Pilot studies**
- **Sharing animals, tissues, or organs**
- **New methods in testing**
  **(e.g. limit test, local lymph node assay, etc.)**

# 3Rs—Reduction/ Refinement

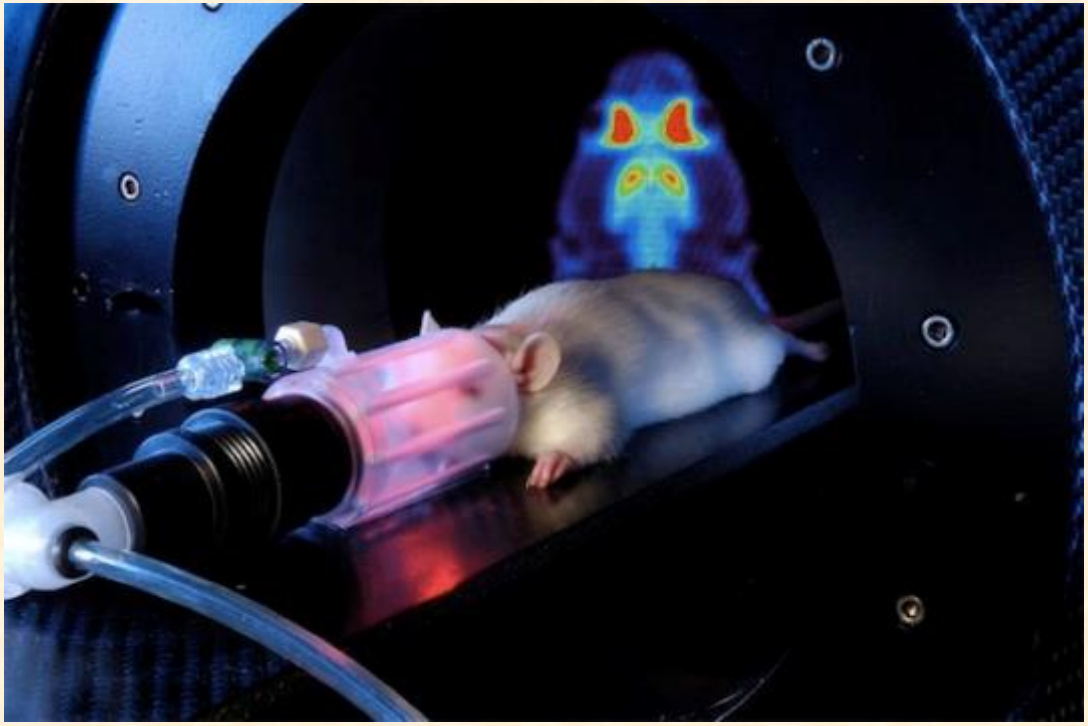
- **Emerging Technologies**
  - **Imaging Devices for Use in Small Animals**
    - positron emission tomography
    - single-photon emission computed tomography
    - computed tomography
    - magnetic resonance imaging
    - ultrasound
    - optical imaging with fluorescent and bioluminescent tracer technology




In vivo imaging modalities, within the context of animal welfare concerns, are seen as **technical refinements** in that they are much less invasive than older diagnostic and monitoring techniques. In addition animal imaging devices now offer the possibility of **reduction of animal sacrifice** through longitudinal study that uses animals as their own controls, thereby also **simultaneously improving science** by the use of the improved statistics of paired observations.

*Wade Koba, et al. (2011). Imaging Devices for Use in Small Animals. Seminars in Nuclear Medicine Volume 41, Issue 3, May 2011, Pages 151–165*

# Imaging



**PET system for small animals**

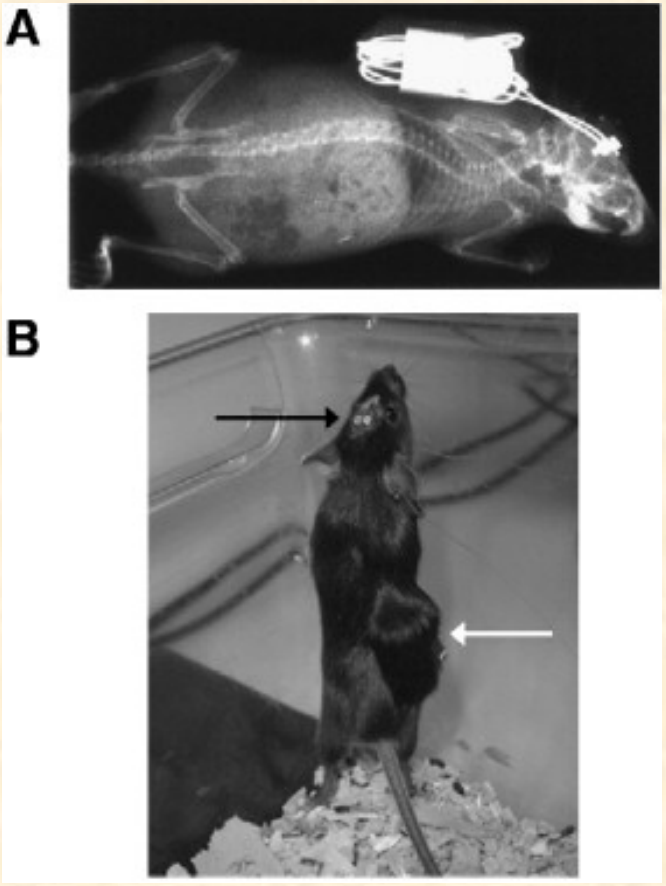
http://zmbe.uni-muenster.de/institutes/izb/stemres_de.htm

# 3Rs—Reduction/ Refinement

- New animal models
  - **Electromyographic telemetry in the development of humane primate model of spinal cord injury. Shanker Nesathurai, et al. 2006. Journal of Medical Primatology 35: 397–400.**
    - One problem limiting development of therapeutic interventions is that **the relevance of rodent models to human spinal cord injury is not clear.** Progress in developing therapies would be better facilitated by a valid, humane non-human primate model that would allow testing of potentially efficacious pharmacological treatments. This brief report addresses the feasibility of this concept. In human spinal cord injury, the primary impairment is the inability to control the limb to perform functional tasks such as walking, grooming, feeding, etc. However, **to propose a primate model of acute spinal cord injury that induce significant hind limb and/ or forelimb limb paralysis would be unacceptable. As well, extensive lesions of the spinal cord could result in bowel and bladder dysfunction. To appropriately address the animal welfare issues, this spinal cord injury model is predicated on a monkey's tail being the 'fifth limb'.** As such, this model focuses on creating a selective, small lesion on one side of the sacral spinal cord that partially impairs movement of the tail.

# 3Rs—Reduction/ Refinement

- Telemetry
  - Affect welfare in several ways
    - Can be used to reduce stress by capturing data without increased handling
    - Can be used to capture data to determine if experimental methods are stressful



# Searching Pubmed - Telemetry

- **Useful Terms**
  - telemetry
  - species
  - data to be collected
- **Example**
  - telemetry and mice
  - Sample citation—shows both reduction of numbers/ refined procedure that minimizes stress
  - **Arras M., et al (2012). Multiparameter telemetry as a sensitive screening method to detect vaccine reactogenicity in mice. PLoS One. 2012;7(1):e29726. Epub 2012 Jan 19.**
    - Reactogenicity often represents a major hurdle to the clinical use of new substances. Yet, **irrespective of its importance, this parameter has remained difficult to screen for, owing to a lack of sensitive small animal models with a capacity for high throughput testing**. Here we report that continuous telemetric measurements of heart rate, heart rate variability, body core temperature and locomotor activity in laboratory mice **readily unmasked systemic side-effects of vaccination, which went undetected by conventional observational assessment and clinical scoring. Using only limited numbers of mice**, this method allows for their automated evaluation, differentiation and selection without sizeable risk for investigator-related bias.

# Alternatives: *Refinement*

*The Principles of Humane Experimental Technique* (1959)

- **Knowledge of species physiology and normal and abnormal behavior**
- **Proper use of anesthetics and analgesics**
- **Modifications in restraint, handling, blood collection**
- **Increased sensitivity of monitoring devices and chemical assays**
- **Proper training of personnel**

# Proper Use of Analgesics

"They all look like this after surgery."



"They all look like this after surgery with post-operative analgesia."

# Social Housing


# Cage Design

# Handling and Training

# Environmental Enrichment

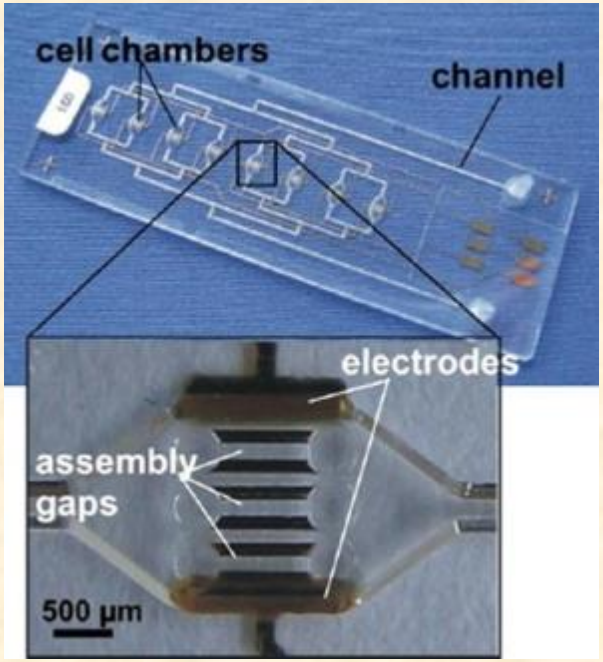
# Alternatives: *Replacement*

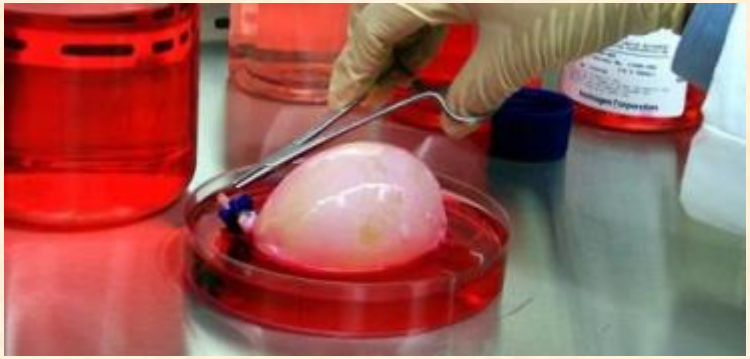
*The Principles of Humane Experimental Technique* (1959)

- **<u>Relative replacement</u> - some animal involvement**
  - **Isolated cell and nerve preparations**
  - **Use of tissues from slaughter house or grocer**
  - **Computer simulations based on in vivo data**

# 3Rs - Replacement

- Emerging Technologies
  - Artificial Organs/Tissue Engineering
    - Liver on a chip
    - Organ/tissue printing technology



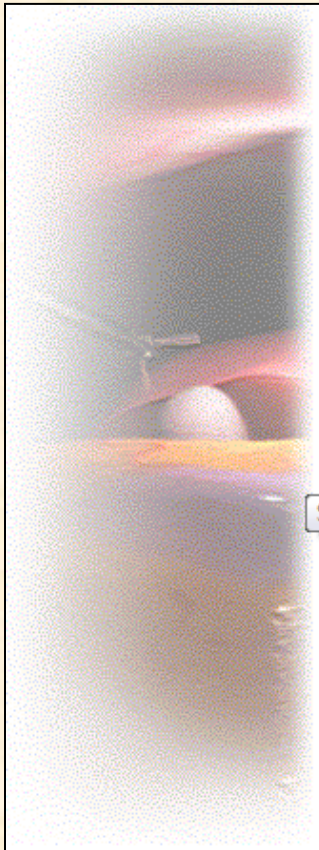



http://www.wakehealth.edu/Research/WFIRM/Research/Engineering-A-Kidney.htm


**Centro de Cirugía de Mínima Invasión Jesús Usón,** Cáceres, Spain

https://www.youtube.com/watch?v=thwn1jQ5oqE

# 3Rs-Replacement/Reduction



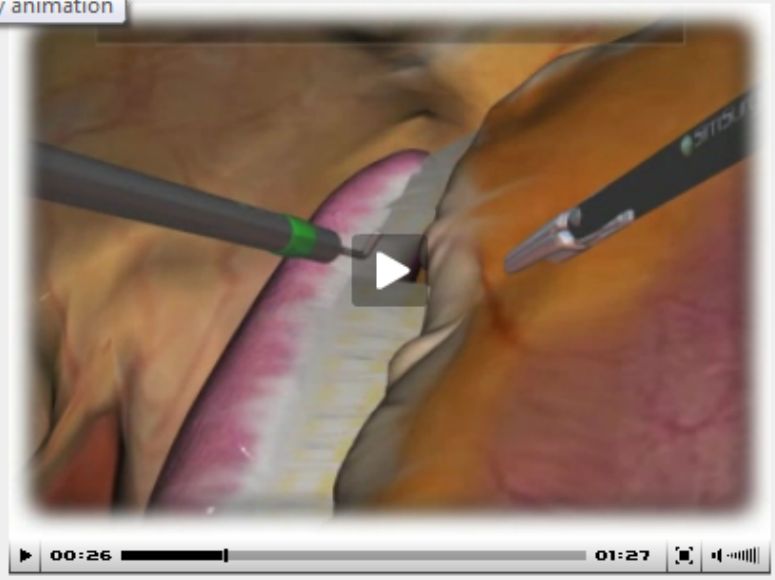
**SEP - Surgical Simulation Platform**

SimSurgery established in 1999, develops and provides simulators for training of surgical skills and procedures in a global market place.

The combination of advanced virtual reality simulation technology and comprehensive training and analysis tools, based on a flexible and intuitive platform makes the **SEP** a clear leader in the field of Virtual Reality simulators in laparoscopy

The simulators are based on advanced VR (Virtual Reality) technology, developed by SimSurgery. The new **D-BOX** manual trainer is developed by former Lapskill Medical and has been merged with SimSurgery as of January 2011.

Simsurgery animation




**Find Out More...**

SimSurgery videos YouTube


http://www.simsurgery.com/

# Virtual Alternatives

**Tim Wilson, Professor of Anatomy, Faculty of Health Sciences, University of Western Ontario, describes his new 3D Virtual Reality Theatre as "the imagination tool of the millennium".**

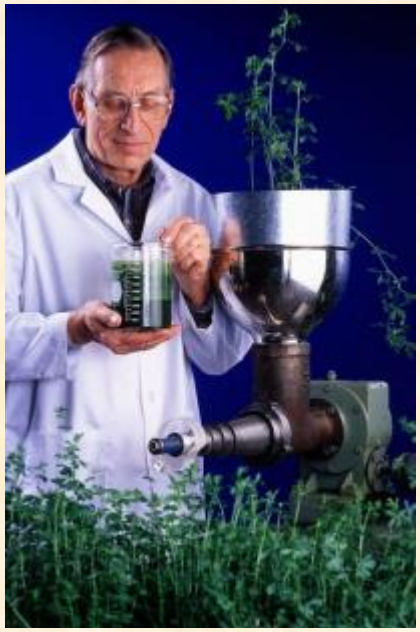
http://www.christiedigital.com

# Non-animal Models Used in Teaching

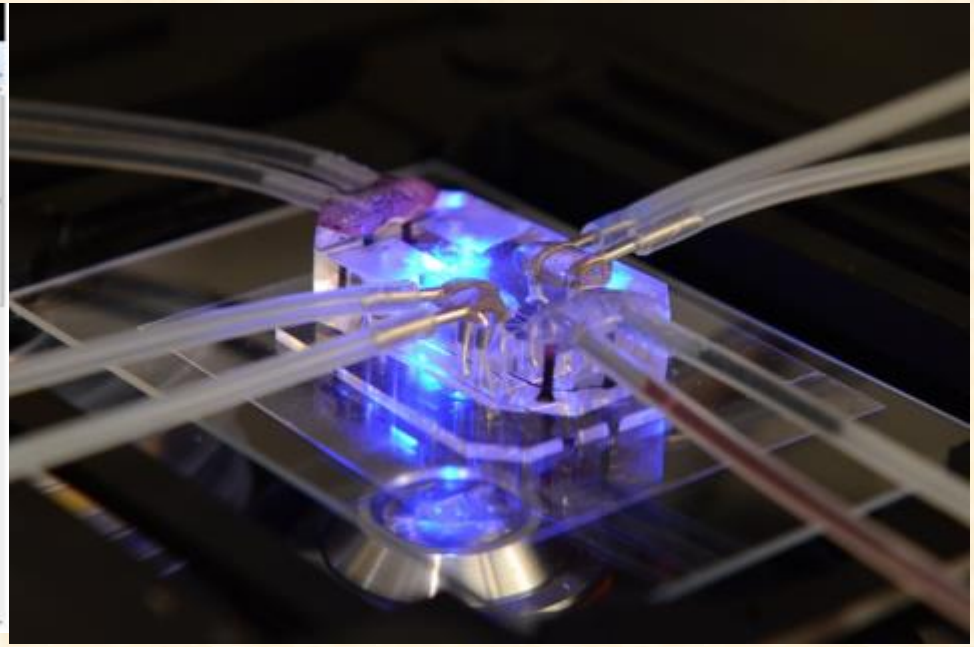
# Alternatives: *Replacement*

*The Principles of Humane Experimental Technique* (1959)

- **<u>Absolute replacement</u> – no animal involvement**
  - **Endoparasites, plants microorganisms**
  - **Computer automated structure evaluation systems**
  - **Human tissue culture**



# Replacement Alternatives

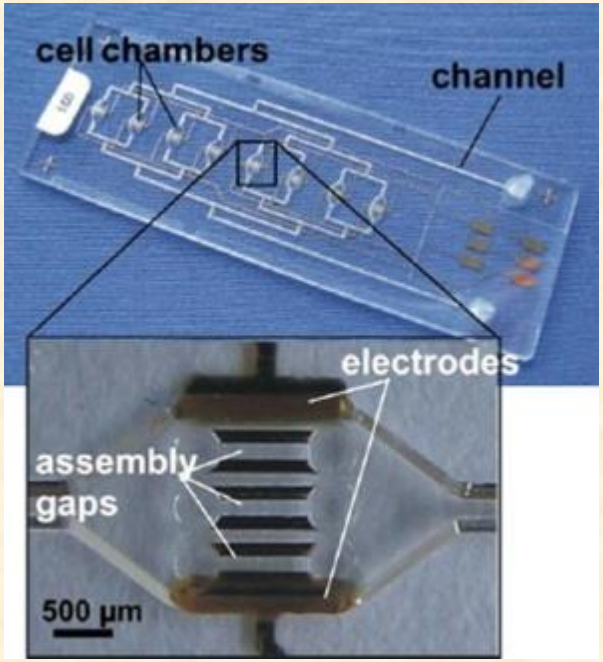



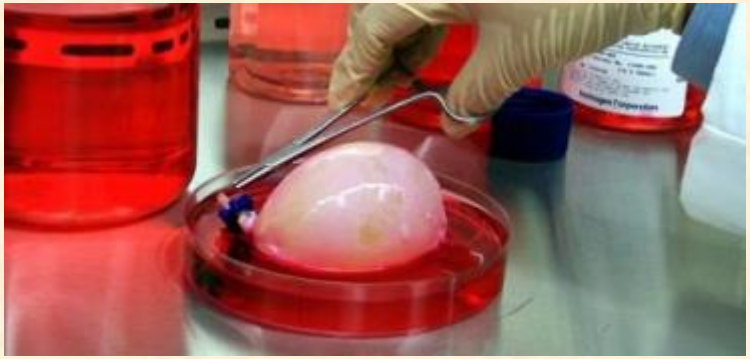
http://vimeo.com/52689891

Lung-on-a-Chip
Wyss Institute for Biologically Inspired Engineering
at Harvard University

# 3Rs - Replacement

- Emerging Technologies
  - Artificial Organs/Tissue Engineering
    - Liver on a chip
    - Organ/tissue printing technology



http://www.wakehealth.edu/Research/WFIRM/Research/Engineering-A-Kidney.htm

# Where Can I Find the Information?

## AWIC Services and Databases

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Home | Animal Welfare Inf...

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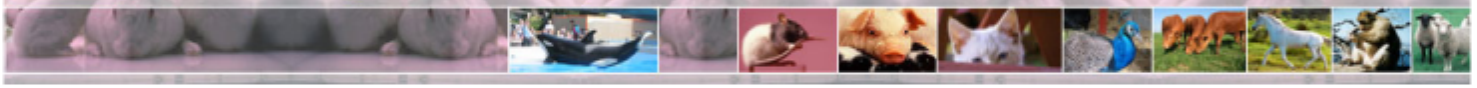
USDA NAL United States Department of Agriculture National Agricultural Library

ANIMAL WELFARE INFORMATION CENTER





**Search AWIC**

Go

- Search all USDA
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**Browse By Subject**

- Alternatives
- Companion Animals
- Farm Animals
- Government and Professional Resources
- Humane Endpoints and Euthanasia
- Literature Searching and Databases
- Pain and Distress
- Research Animals
- Zoo, Circus and Marine Animals

## Home

The **Animal Welfare Information Center (AWIC)** is mandated by the Animal Welfare Act (AWA) to provide information for improved animal care and use in research, testing, and teaching.

**Register now** for the AWIC Workshop on Meeting the Information Requirements of the Animal Welfare Act held at The National Agricultural Library in Beltsville, Maryland.

- **November 13-14, 2014**
- **March 11-12, 2015**
- **May 13-14, 2015**
- **October 28-29, 2015**

### Spotlights

More...

**Animal Welfare Act and Regulations "Blue Book" (September 2013)**

**Training Resources for Animal Care Personnel**


**3R Guide is a new (2014) resource being developed by Norecopa in collaboration with the Animal Welfare Information Center.**

**Alternatives (3Rs) Funding Opportunities**

**Environmental Enrichment for Nonhuman Primates Resource Guide, 2014**

**Presentations from the Symposium on Social Housing of Laboratory Animals (August 2013)**

**I Want To**

- Learn about the Animal Welfare Act
- Recommend Materials for the AWIC Web Site
- Search the NAL Catalog (AGRICOLA)

Follow @AnimalWelfareIC

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**See Also**

- USDA, Animal and Plant Health Inspection Service (APHIS), Animal Care (AC)
- National Institutes of Health, Office of Laboratory Animal Welfare (NIH, OLAW)

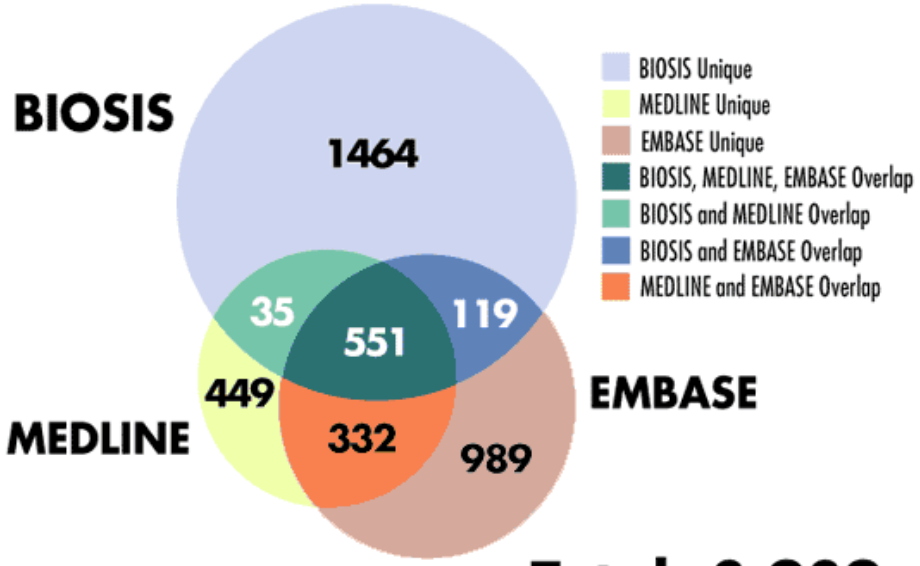
# Databases

## *Biomedical and Biological*

- AGRICOLA http://agricola.nal.usda.gov
- CAB Abstracts
- MEDLINE http://www.ncbi.nlm.nih.gov/pubmed/
- BIOSIS
- Science Direct
- Scopus

# Pharmacokinetics

*pharmacokinetics and pain*




**Total: 3,939**

Without ***BIOSIS Previews***, you would be missing 1,464 unique citations.

In addition to hundreds of journal article records, BIOSIS Unique records contain 415 Meeting records.

# Subject Coverage of Selected Databases

| AGRICOLA | CAB | EMBASE | MEDLINE | BIOSIS |
|---|---|---|---|---|
| General agriculture | General agriculture | Clinical med. | Clinical med. | General agriculture |
| Animal science | Animal sci. & production | Experimental medicine | Experimental medicine | Aerospace biology |
| Chemistry & biochemistry | Crop science | Pharmacology, drugs, potential drugs | Pharmacology | Biochemistry & anatomy |
| Microbiology | Forestry | Biochemistry | Microbiology | Bacteriology (microbiology) |
| Cytology | Pest control | Developmental biology | Administration | Cell biology |
| Human & animal nutrition | Human nutrition | Forensic med. | Nutrition | Botany |
| Biotechnology | Biotechnology | Health econ. | Nutrition | Anatomy |
| Physiology | Pesticides | Occup. health | Anat. & physiol. | Physiology |
| Vet. Medicine | Vet. Medicine | Toxicology | Vet. Medicine | Clinical med. |
| Wildlife | Machinery and buildings | | Occupational medicine | Pathology |
| Zoology | Economics | | Toxicology | Biophysics |
| Entomology | | | Other med. topics | Toxicology |

# Sources of Information for Selected Databases

| AGRICOLA 1970-present | CAB 1972-present | EMBASE 1974-present | MEDLINE 1946-present | BIOSIS 1926-present |
|---|---|---|---|---|
| ~ 1,000 journals | > 9,500 journals/ trans. | ~ 7,500 journals | ~5,500 journals | ~ 5,000 journals |
| Books, Monographs | Books, Monographs | Conference proceedings | | Books, Monographs |
| Proceedings | Symposia | Symposia, Meetings | | Proceedings/abs |
| Research repts. | Technical reports | | | Technical reports |
| Theses | Theses, Dissertations | | | Nomenclat. Rules |
| Transl.—var. | Review journals | | | Annual reviews |
| Bibliographies | Bibliographies | | | Bibliographies |
| Elect. docs. | Patents | | | Patents 86-89 |
| Audio visuals | Annual reports | | | Letters/notes |
| USDA pubs. | Guides | | | Guides |
| Gov. docs | Conferences | | | Research comm. |
| Selected newsltrs | Meetings | | | Conferences |
| Manuals/sops | | | | Symposia |
| Tox. protocols | | | | Meetings |

# Free Online Resources

## *Education*

- InterNICHE (International Network for Humane Education) http://www.interniche.org/

- **Norecopa** (*formerly NORINA*) – Norwegian consensus platform for replacement, reduction and refinement of animal experiments

    - http://oslovet.veths.no/NORINA/
    - http://oslovet.veths.no/teaching/materials.html
    - http://film.oslovet.norecopa.no/
    - http://www.3RGuide.info

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Lab Animal Science
**Alternatives**
National Platform
**Databases**
NORINA
TextBase
Classic AVs
3R Guide
Other databases
**Education**
Requirements
Courses
Compendia
Films & slide shows
Other materials
**Ethics**
**Fish**
Meetings
Projects
Reports
Guidelines
Links
**Health monitoring**
**Legislation**

# Blood Collection in Mice Using the Saphenous Vein - An Alternative to Retro Orbital Collection

**Record number:** 4634

**Category:** Medicine

**Type:** Web pages

**Description:** These web pages describe a method for blood collection from the saphenous vein of mice, rats, hamsters, gerbils, guinea-pigs, mink and ferrets. The technique is available as a slide show and video presentation at

http://film.oslovet.norecopa.no/saphena. The technique is a satisfactory alternative to retro-orbital puncture.

**Search NORINA**

Find alternatives to animals

- All Categories -
- All Types -
- All Text -

GO!

**Free of charge**

Free of charge on the Internet.

**Search for this product at**

Amazon.com

**Browse NORINA**

Latest products

**Search**

Entire website

# Additional Databases

## *Available on the Web*

- NC3Rs Blood Sampling Microsite

  http://www.nc3rs.org.uk/bloodsamplingmicrosite/

- Best Practices for Common Procedures
  http://www.procedureswithcare.org.uk/

Resource hubs

Animals in chemical safety testing

Animals in drug discovery and development

Animals in environmental safety testing

Blood sampling

General principles

Vascular catheters

**Mouse**

Rat

Hamster

Guinea pig

Rabbit

# Mouse

Techniques for taking blood samples from laboratory mice:


Surgical techniques:

Blood vessel cannulation Mouse

Tail snip Mouse

Non-surgical techniques:

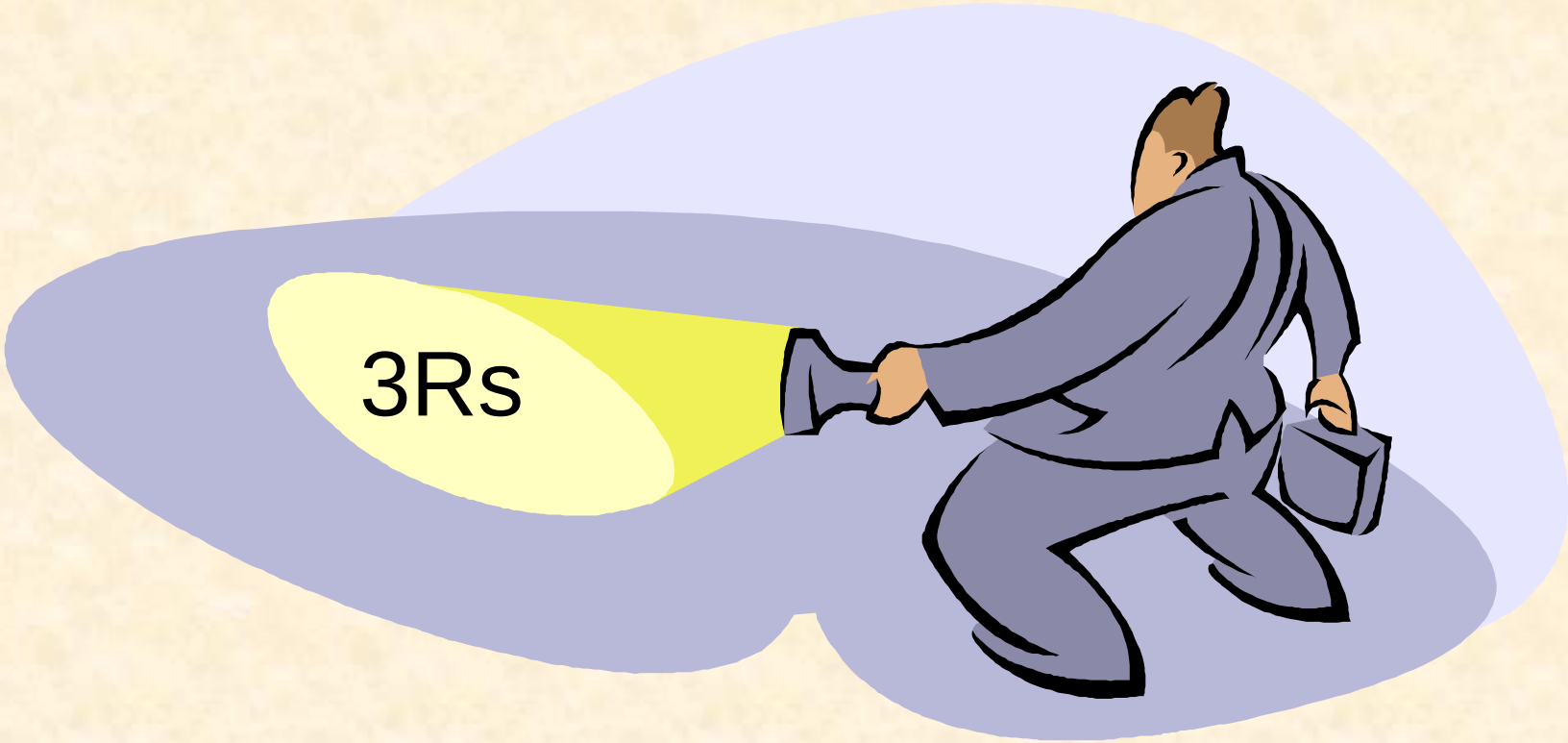
Tail vessel microsampling Mouse

Tail vein Mouse

Saphenous vein Mouse

Retro-orbital Mouse

# Searching for Alternatives:
## Introduction to Search Strategies, Mechanics



# AWIC's Approach to Meeting the Information Requirements

- Analyze the protocol to determine where alternatives might be used and for terminology.
- Decide where to go for the information.
  - Databases
  - Websites
- Link terminology appropriately for best search results.
- Evaluate the search results.

# Searching for Alternatives

- Consists of three types of terms:
  - Scientific terms related to the research protocol;
  - Alternative (3Rs) terminology; and
  - Search terminology: Boolean operators, limits, truncations, years, types of materials…

# Searching for Alternatives

## Tips

- Description of protocol and area of study
- Species being used
- Organ systems involved
- Acronyms (CNS, BSE, MAb)
- Spelling (behavior, behaviour)
- Names of hormones, enzymes, CAS#, trade names (xylazine = rompun)
- Authors in the field including the PI
- Is the PI aware of any possible alternatives?
- Previous searches with keywords, years and databases searched

# Searching for Alternatives

## Alternative Terms: *Refine and Reduce*

- analgesic or analgesia or painkiller
- technique or method or procedure
- anesthetic or anasthetic or anaesthetic
- monitor or evaluate or supervise
- restrain or immobilize or restrict
- positive reinforcement or animal training
- housing or facility or caging

*Note: Most search terms are obtained from the protocol and area of study.*

# Searching for Alternatives

## Alternative Terms: *Replacement*

- artificial or vitro or culture
- tissue or cell or organ
- simulation or digital image or interactive
- mannequin or manikin or model

*Animal Use Alternatives Thesaurus*

http://www.nal.usda.gov/awic/alternatives/alternativeanimalusethesaurus.htm

# Alternatives Search Examples

# Searching for Alternatives
## Sample Search #1 - Trauma

Dr. Stan Breager uses pigs and dogs in his advanced trauma life support training course. All procedures are conducted on anesthetized animals. When the training session is complete, all animals are euthanized. His IACUC has requested that he search for any potential alternatives to the use of animals.

***Create the best search strategy to address alternatives.***

# Searching for Alternatives

## Search Strategy - Sample Search #1 – Trauma Training

**Search History: All Databases**

| Set | Results | Save History / Open Saved History |
|---|---|---|
| # 7 | 263 | #4 AND #2 AND #1<br>**Refined by: RESEARCH DOMAINS:** ( SCIENCE TECHNOLOGY )<br>*Timespan=All years*<br>*Search language=Auto* |
| # 6 | 272 | #4 AND #2 AND #1<br>*Timespan=All years*<br>*Search language=English* |
| # 5 | 6 | #3 AND #2 AND #1<br>*Timespan=All years*<br>*Search language=English* |
| # 4 | Approximately 3,185,476 | **TITLE:** (alternative* or model* or simulat* or cadav* or carcas* or software or video* or interact* or digital* or virtual or mannequin* or manikin* or computer*)<br>*Timespan=All years*<br>*Search language=English* |
| # 3 | Approximately 989,130 | **TITLE:** (dog or dogs or canine* or pig or pigs or swine or piglet* or ferret* or cat or cats or animal or animals or goat*)<br>*Timespan=All years*<br>*Search language=English* |
| # 2 | Approximately 787,849 | **TITLE:** (train* or teach* or educat* or instruct* or tutor*)<br>*Timespan=All years*<br>*Search language=English* |
| # 1 | Approximately 126,489 | **TITLE:** (trauma or "life support" or "emergenc* medic*" or ems or emst or atls or "advanced trauma life support")<br>*Timespan=All years*<br>*Search language=English* |

# Searching for Alternatives
## Trauma Sample Citations

### Animal Models

- **Use of the ferret as a model for pediatric endotracheal intubation training.**
- **Swine and dynamic ultrasound models for trauma ultrasound testing of surgical residents.**
- **Ocular trauma modeling**
- **Ultrasound training during ATLS: An early start for surgical interns.**
- **Battlefield Biomedical Technologies**
- **Removal of corneal foreign bodies: an instructional model**

# Searching for Alternatives

## Trauma Sample Citations

### Non-Animal Models and Alternative Methods

- **Virtual reality enhanced mannequin (VREM) that is well received by resuscitation experts**
- **Effect of feedback on delaying deterioration in quality of compressions during 2 minutes of continuous chest compressions: A randomized manikin study investigating performance with and without feedback**
- **A simple device to teach tube thoracostomy**
- **Virtual reality, robotics, and other wizardry in 21st century trauma care.**
- **Practicing procedures on the recently dead.**
- **Paediatric resuscitation manikins.**
- **Animal cadaveric models for advanced trauma life support training.**
- **Medical Simulation for Trauma Management.**

# Trauma Training – Web Search Examples

- **Norina**
  - **Innovations in Trauma Training.** The Innovations in Trauma Training video from Physicians Committee for Responsible Medicine (PCRM) looks at an exciting program that uses life-like simulators and human cadavers to train physicians to provide emergency care to trauma victims. Type: Video Film. Category: Human Medicine & Surgery (human).
  - **K-9 Thoracentesis Mannikin.** This special K-9 training mannikin allows for chest tube placement as well as ability to aspirate air & fluid from the thoracic cavity to simulate emergency trauma. Type of record: Model. Category: Medicine
  - **Critical Care Jerry.** All the features of the "Advanced Airway Jerry" (record number 4909) and the "K-9 IV Trainer Arm" (record number 4908) in one "body". Type: Model. Category: Handling & Veterinary Medicine.

# Search Sample #1
## What's Missing?

- The protocol and/or detailed description of procedures performed on the animals such as:
  - Thoracotomy
  - Intubation
  - Chest tube insertion
  - Venous cut-down

# Scopus

The largest abstract and citation database of peer-reviewed literature.

# Search Sample #2

Scopus is one of the largest abstract and citation database of peer-reviewed literature with tools to track, analyze and visualize research. It contains over 21,000 titles from more than 5,000 publishers around the world, covering the fields of science, technology, medicine, social sciences, and Arts & Humanities. Scopus has 50 million records dating back to 1823, 84% of these containing references dating from 1996.

## Coverage of Journals:

- All Journals within Medline, Embase and EiCompendex
- Most Veterinary Journals within CAB and Agricola
- Most Laboratory Journals within Medline and Agricola

# SCOPUS Commands

- AND is assumed when more than one word or phrase is entered in the same text box without using an operator.

Example: animal welfare searches animal AND welfare

- " " Use Quotes to search an exact phase.

Example: "heart attack" finds the phrase heart-attack and heart attack and heart attacks
(Plurals are included)

# SCOPUS Commands

## Boolean Operators

**OR** Select at least ONE word from set.
swine or pig or pigs or porcine

**AND** Select more than one word from set.
swine and euthan*

**AND NOT** Eliminates a search term or group of search terms.
(pig or pigs or swine or porcine) AND NOT guinea

*Searches with multiple operators are processed in the following precedence order:*

1. *OR*
2. *AND*
3. *AND NOT*

*After the precedence rules are applied, the search is read left to right.*

# SCOPUS Commands

## Wildcard for searching for word variations

* Replace multiple characters anywhere in a word.

Examples:

- behav* finds behave, behaves, behaviour, behavior, etc.
- *estrogen finds estrogen or oestrogen

# SCOPUS Commands

## Proximity Operators

- **PRE/n** "precedes by". Where the first term in the search must precede the second by a specified number of terms (n).

  Examples:

  - behav* PRE/3 disturbance* finds articles where various ending of the word "behav*" precedes various endings of the word "disturbance*" by three or fewer words.
  - heart PRE/0 attack returns the same results as "heart attack“
  - route PRE/2 administration returns route of administration and route of drug administration.

# Searching for Alternatives

## Proximity Operators

**W/n** "within" - Where the terms in the search must be within a specified number of terms (n). Words are adjacent, but in either order.

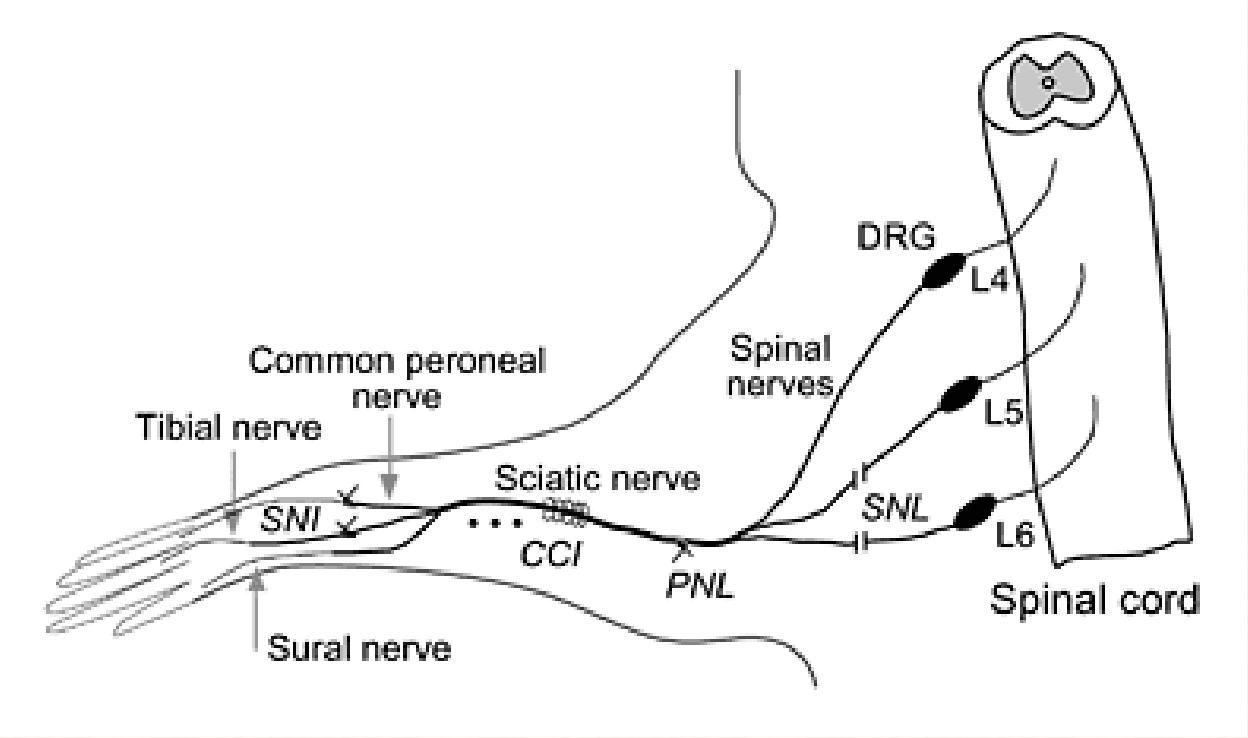
Examples:

- pain W/5 morphine finds articles in which "pain" and "morphine" are no more than 5 terms apart.
- blood W/2 sampl* finds blood sample, blood plasma sample, sampling of arterial blood


**Tutorial -** http://help.elsevier.com/app/answers/detail/a_id/3706/p/8150/c/8270

# Search Sample #2 – Neuropathic Pain

Do NSAIDs, opioids, or other analgesics lead to different outcomes for spared nerve models of neuropathic pain?



# Search Sample #2 – Neuropathic Pain

## Search Strategy using Scopus

| Set | Terms Searched | Items |
|---|---|---|
| #1 | "SPARED NERVE INJURY" AND NEUROPATH* | 995 |
| #2 | PAIN? (W/8) (SURG* OR POSTSURG* OR POSTOPER* OR POST(PRE/1)SURG? OR POST (PRE/1)OPER* OR INCISION* | 24858 |
| #3 | #1 AND #2 | 39 |

# Influence of postoperative analgesics on the development of neuropathic pain in rats.

**Stewart LS, Martin WJ.**

**Comp Med. 2003 Feb;53(1):29-36.**

**Rodent models of neuropathic pain require extensive tissue manipulation to induce the lesion of interest which results in inflammation and postoperative pain that is unrelated to nerve injury per se. We sought to determine whether acute postoperative pain management affects the development of hallmark signs of neuropathic pain. Analgesic regimens (q 24 h x 3 days) were buprenorphine (0.05 and 0.1 mg/kg of body weight, s.c.), flunixin meglumine (1.1 and 2.5 mg/kg, s.c.), and fentanyl citrate (0.01 and 0.1 mg/kg, i.p.). The spared nerve injury model of neuropathic pain was used, and mechanical and cold allodynia as well as body weight gain were measured for 28 days. Buprenorphine and fentanyl alleviated mechanical sensitivity and prevented weight loss associated with the surgery (0 to 3 days), but opioid-related adverse effects were observed. Flunixin reduced wound inflammation and improved weight gain, but had no effect on nociceptive thresholds. Cold allodynia was unaltered by any treatment. By postoperative day 7, control and treatment groups did not differ with respect to weight gain or nociceptive thresholds. Our findings suggest that postsurgical inflammation and pain behavior can be ameliorated without substantially altering the long-term development of neuropathic pain, provided that the selection of agent(s) and treatment regimen(s) is appropriate and the neuropathic pain of interest is evaluated seven days after surgery.**

**MeSH Terms**

**Analgesics/therapeutic use***
**Animals**
**Cold Temperature**
**Male**
**Pain/drug therapy***
**Peripheral Nervous System Diseases/drug therapy***
**Postoperative Period**
**Rats**
**Rats, Sprague-Dawley**
**Weight Gain**

# *A single subanesthetic dose of ketamine relieves depression-like behaviors induced by neuropathic pain in rats.*

Wang Jing; Goffer Yossef; Xu Duo; Tukey David S; Shamir D B; Eberle Sarah E ; Zou Anthony H; Blanck Thomas J J; Ziff Edward B
*Anesthesiology *(* United States ) Oct 2011 , 115 (4) p812-21 ,*

BACKGROUND: Chronic pain is associated with depression. In rodents, pain is often assessed by sensory hypersensitivity, which does not sufficiently measure affective responses. Low-dose ketamine has been used to treat both pain and depression, but it is not clear whether ketamine can relieve depression associated with chronic pain and whether this antidepressant effect depends on its antinociceptive properties. METHODS: The authors examined whether the spared nerve injury model of neuropathic pain induces depressive behavior in rats, using sucrose preference test and forced swim test, and tested whether a subanesthetic dose of ketamine treats spared nerve injury-induced depression. RESULTS: Spared nerve injury-treated rats, compared with control rats, showed decreased sucrose preference (0.719 +/- 0.068 (mean +/- SEM) vs. 0.946+/- 0.010) and enhanced immobility in the forced swim test (107.3 +/- 14.6s vs. 56.2 +/- 12.5s). Further, sham-operated rats demonstrated depressive behaviors in the acute postoperative period (0.790 +/- 0.062 on postoperative day 2). **A single subanesthetic dose of ketamine (10 mg/kg) did not alter spared nerve injury-induced hypersensitivity; however, it treated spared nerve injury-associated depression-like behaviors** (0.896 +/- 0.020 for ketamine vs. 0.663 +/- 0.080 for control rats 1 day after administration; 0.858 +/- 0.017 for ketamine vs. 0.683 +/- 0.077 for control rats 5 days after administration). CONCLUSIONS: **Chronic neuropathic pain leads to depression-like behaviors. The postoperative period also confers vulnerability to depression, possibly due to acute pain. Sucrose preference test and forced swim test may be used to compliment sensory tests for assessment of pain in animal studies. Low-dose ketamine can treat depression-like behaviors induced by chronic neuropathic pain.**

*Tags: * Male

*Descriptors: * *Anesthetics, Dissociative--pharmacology--PD; *Antidepressive Agents; *Depression--etiology--ET; *Depression--psychology--PX; *Ketamine --pharmacology--PD; *Neuralgia--drug therapy--DT; *Neuralgia--psychology --PX *; * Animals; Behavior, Animal--drug effects--DE; Cold Temperature—diagnostic use--DU; Corticosterone--blood--BL; Dose-Response Relationship, Drug; Hyperalgesia--psychology--PX; Neuralgia--complications--CO; Pain Measurement--drug effects--DE; Physical Stimulation; Rats; Rats, Sprague-Dawley; Sucrose--diagnostic use--DU; Swimming--psychology--PX; Taste--drug effects—DE

# *Effect of post operative drug treatment on the development of mechano-cold allodynia in rats following spared nerve injury (SNI) *

Oerther S.; Stenfors C.

European Journal of Pain Supplements ( Eur. J. Pain Suppl. ) September 1, 2011 , 5/1 (220)
<http://dx.doi.org/ 10.1016/S1754-3207(11)70756-8>

Background and Aims: Spared nerve injury (SNI) is a traumatic nerve-injury model used in rat to mimic chronic neuropathic pain condition in man. The response to mechano-cold stimuli after nerve injury in Lewis rats (LEW/HanHsd) is used to measure development of hypersensitivity in these rats. Acute pain is linked to the post operative phase. **In this study we investigated the effect of post-operative pain medication on the long term development of mechano-cold allodynia.** Methods: The surgery was conducted under isoflurane anaesthesia in male rats (n = 7-8 per group). Prior to surgery, one group of rats were given s.c. doses of Temgesic (buprenorphine) (0.05 mg/kg) and Rimadyl (carprofen)(5 mg/kg), diluted in saline followed by a second dose of Temgesic 6-8 hours post surgically. Another group of SNI rats were given saline injections as control. All animals were tested for their response to cold stimuli applied to the plantar surface of the injured paw using a modified ethyl chloride spray can. Both SNI groups were tested if a single dose of morphine (6.25 mumol/kg, sc) could reverse the response to ethyl chloride 30 minutes post drug administration. Results: The SNI-operated rats showed consistent aversive reactions in response to mechano-cold stimuli applied to the injured paw. **Post operative Temgesic/Rimadyl treatment did not affect the response to mechano-cold stimuli. Morphine decreased the response in all rats whether post operative pain management was applied or not. Conclusions: Post operative pain management did not influence the response to mechano-cold stimuli in SNI rats.**

*Drug Descriptors: * buprenorphine; sodium chloride; chloroethane; morphine; carprofen; isoflurane

*Medical Descriptors: * rat; *pain; *drug therapy; *nerve injury; *allodynia; *Europe stimulus; male; surgery; single drug dose; drug administration; aerosol; neuropathic pain; human; Lewis rat; hypersensitivity; model; anesthesia; injection

*__Can a focus on the translatability of preclinical pain research benefit research animals?__ *

Duffus S.E.G.; Griffin G.; Sawynok J.

Altex ( Altex ) March 1, 2011 , 28/-, SPEC. ISS. (260)
*URL: *http://www.altex.ch/resources/WC8_Abstracts_book3.pdf

Neuropathic pain, a chronic and debilitating condition in humans, is often modeled in animals by inducing nerve injury. Pain-related sensory changes studied in these models include hypersensitivity to thermal stimuli (hyperalgesia), light touch (mechanical allodynia), and the injection of painful chemicals (chemogenic hypersensitivity). In modeling neuropathic pain, it is important to closely replicate the clinical condition to improve translatability. **The current study explored preventive analgesia for postoperative neuropathic pain. Since human patients routinely receive postoperative morphine as part of their analgesic regime, the impact of postoperative morphine on the preventive effects of drugs being studied needed to be determined.** Previous research using the spared nerve injury (SNI) model of neuropathic pain demonstrated that amitriptyline has preventive anti-hyperalgesic effects that are not significantly altered by postoperative morphine administration. In this study, propentofylline (1 h preoperatively and then daily for 7 days) alleviated long-term mechanical allodynia in the SNI model. This was not affected by morphine administration (postoperatively and daily for 3 days). **When given in combination, propentofylline and amitriptyline maintain their individual long-term effects in the presence of postoperative morphine.** Many nerve injury models, including the SNI model, involve extensive tissue manipulation to produce physical injury to a nerve(s), causing pain and inflammation that may not be related to the long-term sensory changes of interest. **Here the exploration of postoperative morphine, to improve translatability, likely provided the rats with relief from pain which was not necessary for the study outcomes, and represents a potential refinement for further studies using this model.**

Drug Descriptors: *morphine; amitriptyline; propentofylline; analgesic agent
Medical Descriptors: *pain; *biomedicine; *animal use model; neuropathic pain; nerve injury; human; hypersensitivity; allodynia; patient; tissues; rat; injury; nerve; inflammation; analgesia; injection; stimulus; hyperalgesia

**Evaluation of Post-operative Analgesics in a Model of Neuropathic Pain**

**Authors:** Simkins, Mikele D.; Shadiack, Annette M.; Burns, Carol A.; Molino, Lory J.; Amaratunga, Dhammika; Hall, Jeffery; Rogers, Kathryn E.; Clark, Laura P.

**Source:** Journal of the American Association for Laboratory Animal Science, Volume 37, Number 6, November 1998 , pp. 61-63(3)

**Abstract:**

Chung model-operated animals received analgesic doses of oxymorphone, buprenorphine, carprofen, and EMLA cream (2.5% lidocaine and 2.5% prilocaine) on days 0-4 post-operatively to examine their effects on the development of neuropathic pain in the rat. Although the animals receiving oxymorphone and buprenorphine showed signs of marked sedation, 67% and 60% respectively had developed mechanical allodynia (a form of neuropathic pain) on day 8 post-operatively. The carprofen treated group showed none of the signs of sedation, and on day 14 post-operatively 60% of the animals had developed mechanical allodynia. The EMLA cream-treated group did not show overt signs of post-operative pain or sedation, and 50% developed mechanical allodynia on day 3 post-operatively. **Although the time course of development of mechanical allodynia differed between treatment groups, we find that post-operative analgesics can be delivered to rats during the immediate postoperative period without inhibiting the eventual development of neuropathic pain in this animal model.**

# Search Evaluation
## The PI Role

- Check terminology, strategy, sources, and dates of search.
- Review the search **before** completing the protocol.
- Assess and evaluate the alternative possibilities.
- Be prepared to support the use or non-use of any alternatives in writing.
- Keep a copy of strategy, databases searched, and years of search for future use.

# Search Evaluation
## The IACUC Role

- Review the protocol form. Are the questions asked in a clear way to gather the information needed?
- Review the
  - **Databases searched,**
  - **Terminology used *and***
  - **Years of coverage**.
- Review the search strategy.
- Ask about the order of search and protocol writing.
- Have an information provider on the committee as a resource.

# Search Evaluation
## Red Flags

- Search completed at the last minute.
- Only 1 database searched.
- Terms only for painful aspects.
- The term “alternative” used alone with no other alternative terms.
- Keywords listed not relevant to protocol.
- Keywords and concepts linked in an incorrect manner (e.g. wrong Boolean operators).
- Search doesn’t cover adequate time period (5-10 years).

# Contacting AWIC

**Tel: (301) 504-6212**

**E-mail:** awic@ars.usda.gov
**Online:** http://awic.nal.usda.gov

**Contact Us:** http://awic.nal.usda.gov/contact-us

**Animal Welfare Information Center**
**National Agricultural Library**
**10301 Baltimore Avenue, Room 118**
**Beltsville, MD 20705**