# Scripps Research Alcohol Center Neuroscience Course

## Using animals to study the brain & Neuroscience methods


Amanda Roberts

Senior Scientific Director

Animal Models Core

Alcohol Research Center Dissemination Core

Sahithi Chekuri

Monte Clark

Interns


July 1, 2024

Scripps Research

Science Changing Life

# Use of laboratory animals in biomedical research

- Important contributions to medical progress
  - according to the American Medical Association, “Virtually every advance in medical science, from antibiotics and vaccines to antidepressant drugs and organ transplants, has been achieved either directly or indirectly through the use of animals in laboratory experiments.”
- Cause of heated public, scientific and philosophical discussion
- Animal welfare
  - ensure that research animals are treated as humanely as possible and are used only for important studies.

# New concept: Animal Model

- A non-human species used in biomedical research because it can mimic aspects of a biological process or disease found in humans
- Animal models are sufficiently like humans in their anatomy, physiology or response to a pathogen that researchers can use the results of animal model studies to better understand human physiology and disease.
- By using animal models, researchers can perform experiments that would be impractical or ethically prohibited with humans.

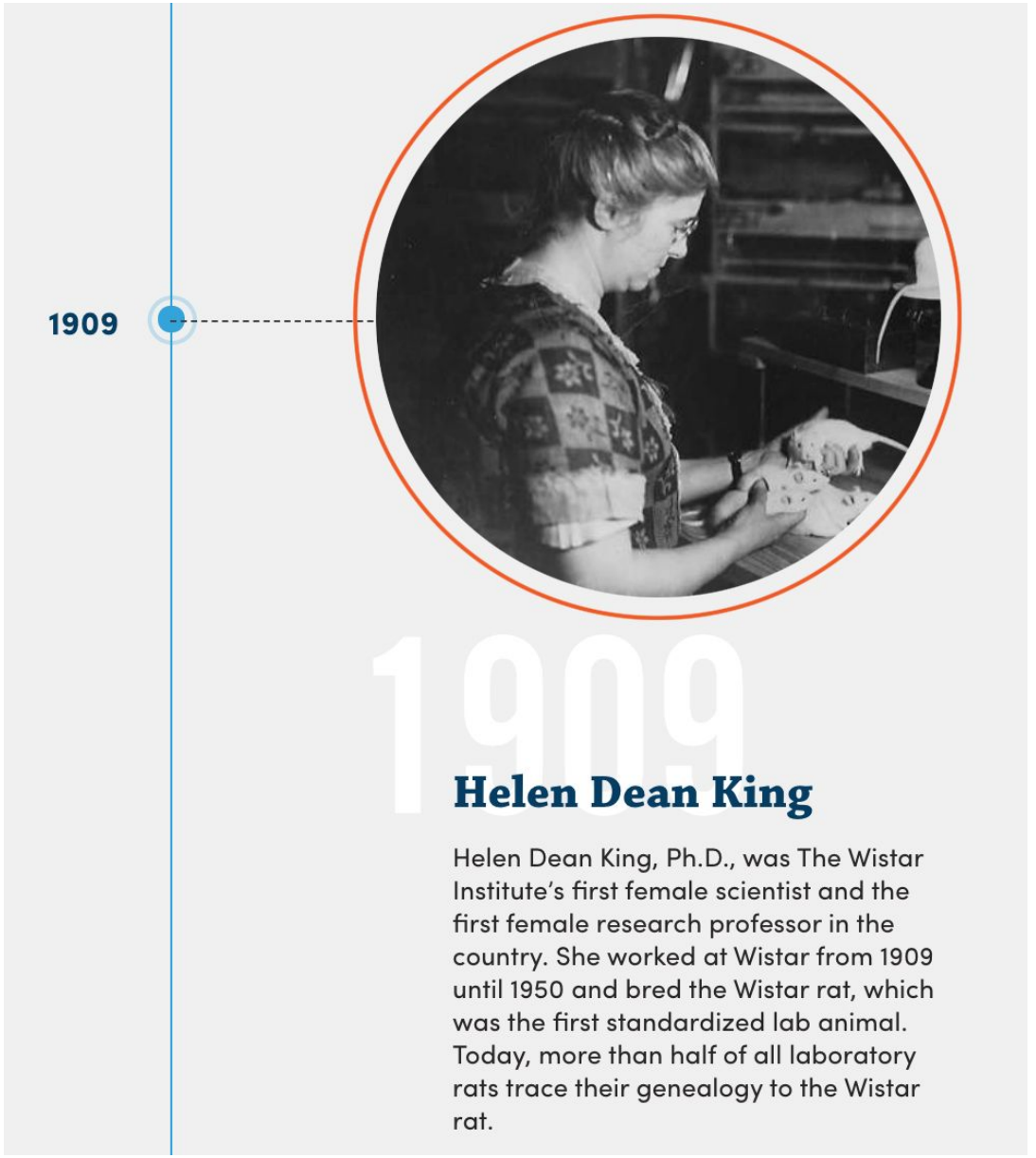
MICE

RATS

# History of the research rat

Notorious rat catcher, Jack Black

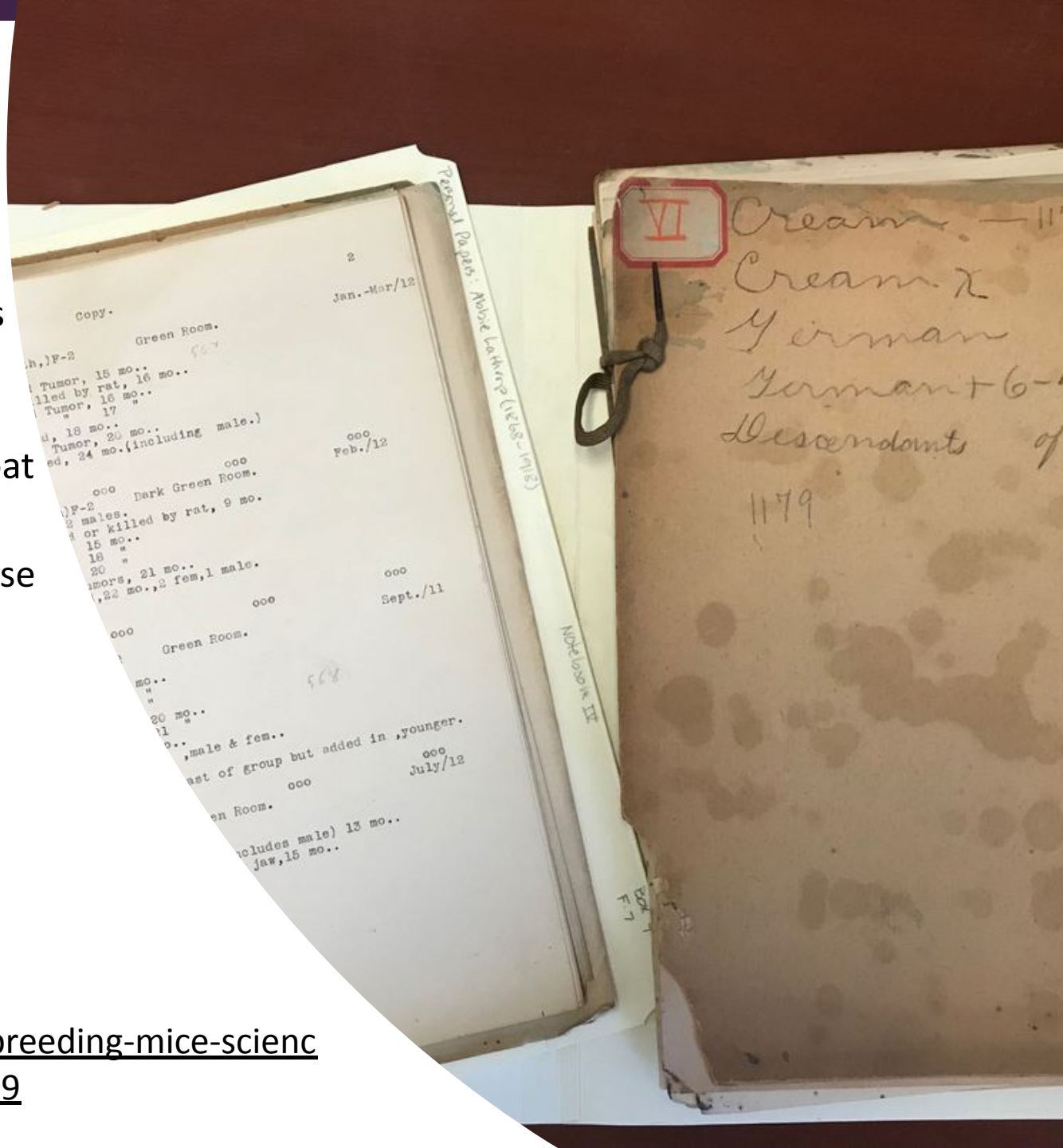
- Black plague (14th century)
- Rat catchers
- Rat baiting pits
- Breeding as pets for royalty
- First experiment: 1828 (effects of fasting on proteins)
- First supplier: Wistar Institute 1906




https://eureka.criver.com/the-early-history-of-the-lab-rat/

# History of the research mouse

- The house mouse (Mus musculus) has followed humans across the globe and likely has one of the widest distributions of all mammals
- late 1800's-early 1900's: Fancy mice bred for unusual coat colors and behavioral patterns by hobbyists
- 1902: Abbie Lathrop helped establish the standard mouse model and pioneered research into cancer inheritance (sold mice to Harvard)
- 1929: Jackson Laboratory in Bar Harbor, Maine started and mouse strains became standardized

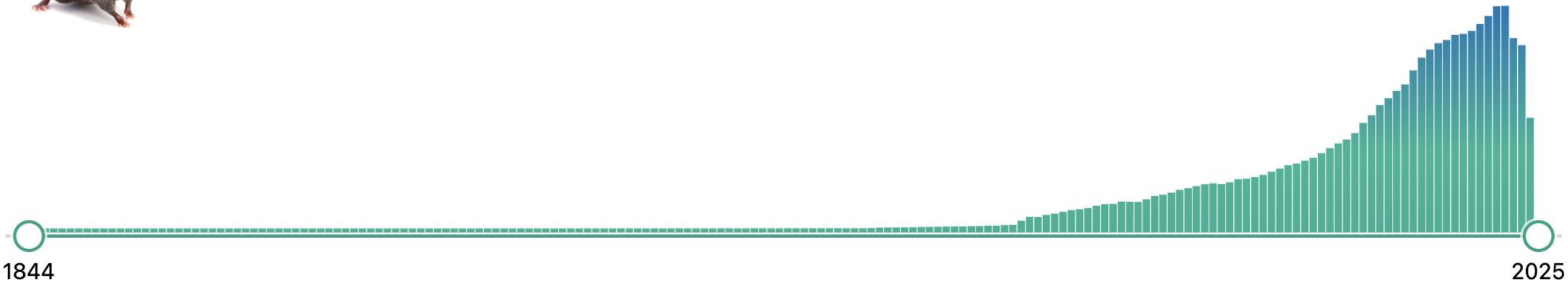



https://www.smithsonianmag.com/science-nature/history-breeding-mice-science-leads-back-woman-barn-180968441/#4gh6ElcQTdJYvfhZ.99

# “Mouse” and “Rat” as a search terms in PubMed

2,100,726 results

2021: 95,132 papers




1,885,572 results

2021: 40,020 papers

# Animal welfare

**"Proper use of animals, including the avoidance or minimization of discomfort, distress, and pain when consistent with sound scientific practices, is imperative." *U.S. Government Principle IV, 1985***

- **Legislation**
  - 1966: Animal Welfare Act
  - 1985: Health Research Extension Act
- **Oversight**
  - Office of Laboratory Animal Welfare (OLAW) – oversees care & use of lab animals
  - Association for the Assessment and Accreditation of Laboratory Animal Care International (AAALAC) – visits/inspects facilities every 3 years
  - Institutional Animal Care and Use Committees (IACUC) – reviews all projects involving lab animals – includes policy experts, vets, scientists, & community members

Scripps Research

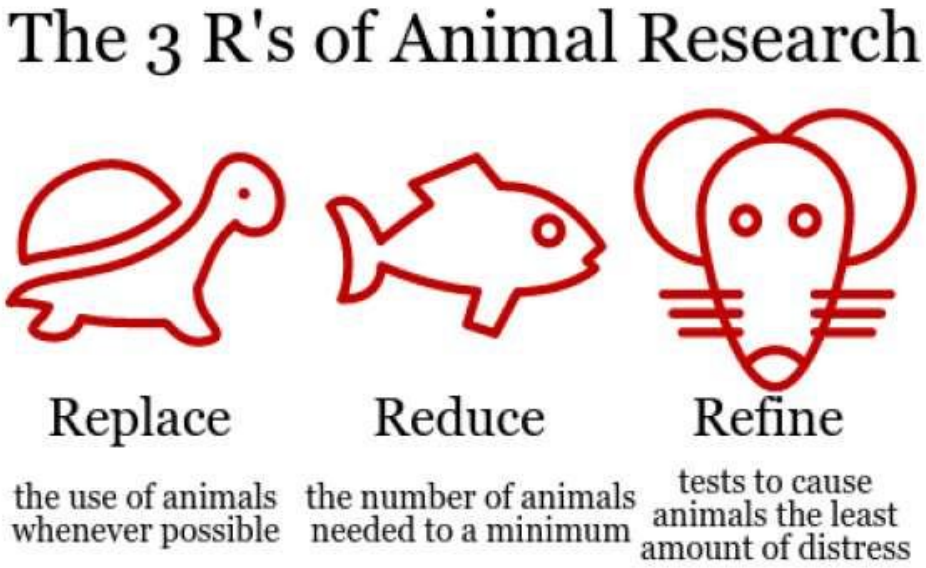
National Institutes of Health
Office of Laboratory Animal Welfare

Office of Laboratory Animal Welfare
OLAW

aaalac
INTERNATIONAL
PROUDLY, AN AAALAC ACCREDITED PROGRAM

# Scientists' responsibilities

- Describing proposed use of animals in grant applications
- Obtaining approval of detailed protocol prior to using animals and prior to implementing significant changes
- Ensuring research is conducted according to this protocol
- Complying with institutional policies and procedures
- Addressing significant changes to the use of animals in progress reports

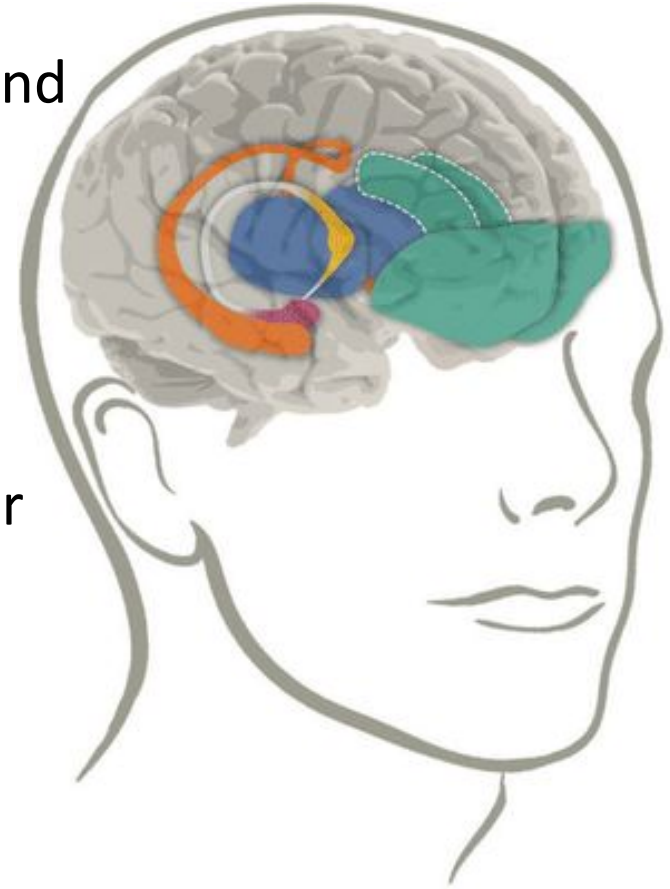


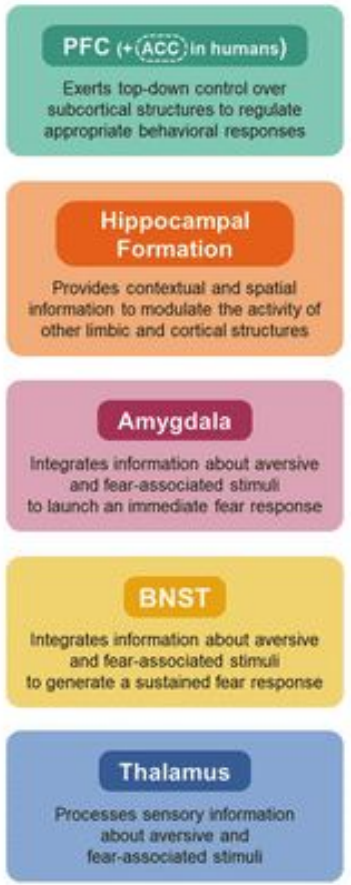
# Rodent research: practical considerations

- Small
- Easy to transport
- Do well in laboratory settings
- Prolific breeders
- Short generation time
- Short life span – life cycle and disease progression ~2-3 years
- Social animals
- Control over genetic background
- Control over environment

# Rodent research: biological considerations

- Similar to humans in anatomy, physiology, and genetics
- Will self-administer alcohol & drugs
- Reward circuitry similar
- Can manipulate
  - Genetics
  - Pharmacology
  - Circuitry






Scripps Research

Flores Á, Fullana MÀ, Soriano-Mas C, Andero R. *Mol Psychiatry*. 2018;23(11):2122-2132. doi:10.1038/s41380-017-0006-0

# Experimental considerations

- Age
- Sex
- Group size
- Control groups
- Housing/environmental conditions
  - Light cycle
  - Temperature
  - Number per cage
  - Enrichment
  - Cage changing
  - Food and bedding
  - Microbial status of colony

# Take Home Messages

- While there is understandable controversy about using animals in research, human health has been very much improved because of it!
- Scientists are required to justify their use of animals and follow strict guidelines
- Rats and mice have quite similar reward circuitry to humans and have been very important for furthering our understanding of the effects of alcohol and drugs on the brain

# A couple of examples of neuroscience methods used in lab animals

- Optogenetics
  - Using light to stimulate neurons
  - Can look at how turning the light on and off can affect behavior
- Electrophysiology
  - Recording electrical activity from specific neurons in the brain
  - Can look at how cells are communicating after exposure to alcohol or drugs, for example

# MIND CONTROL?

# Electrophysiology lab tour