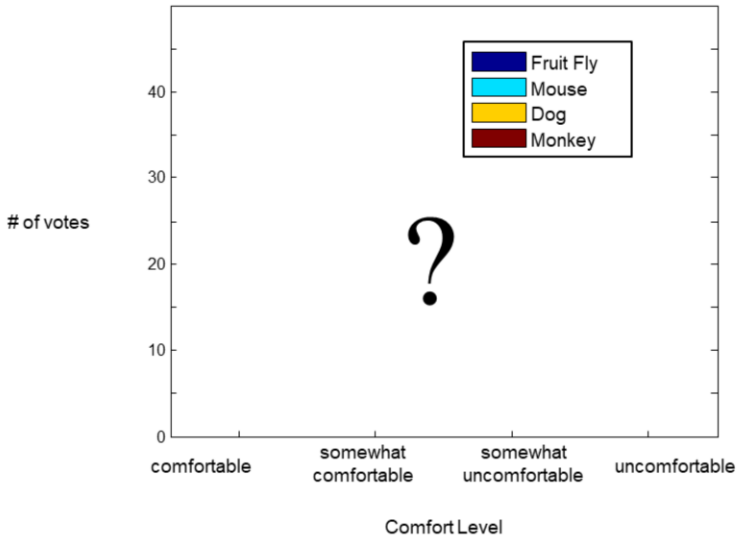
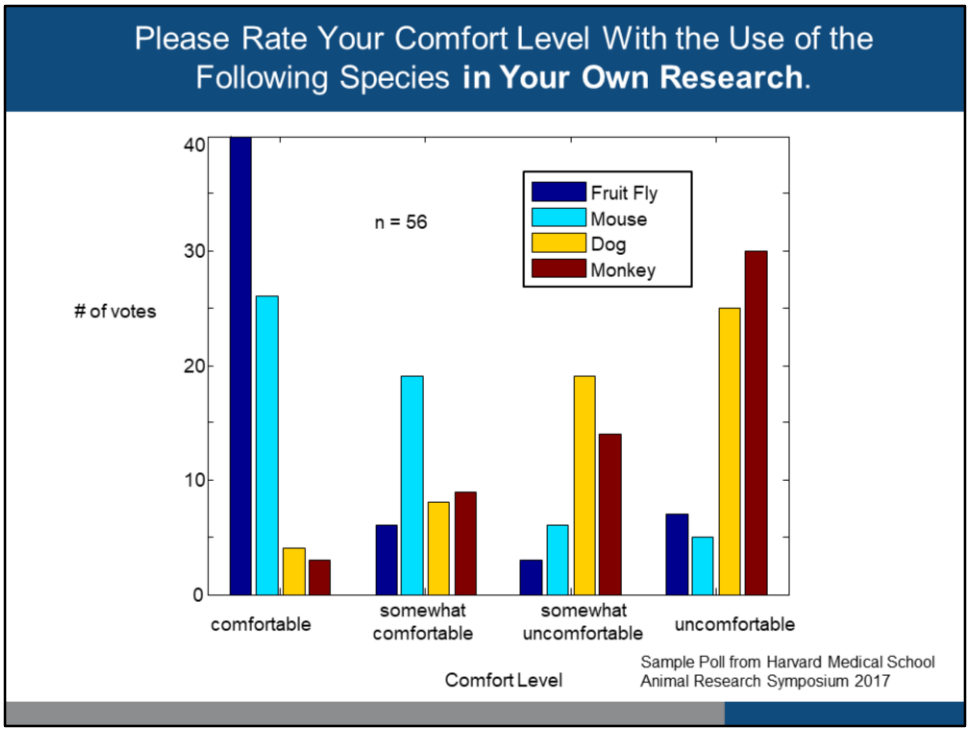
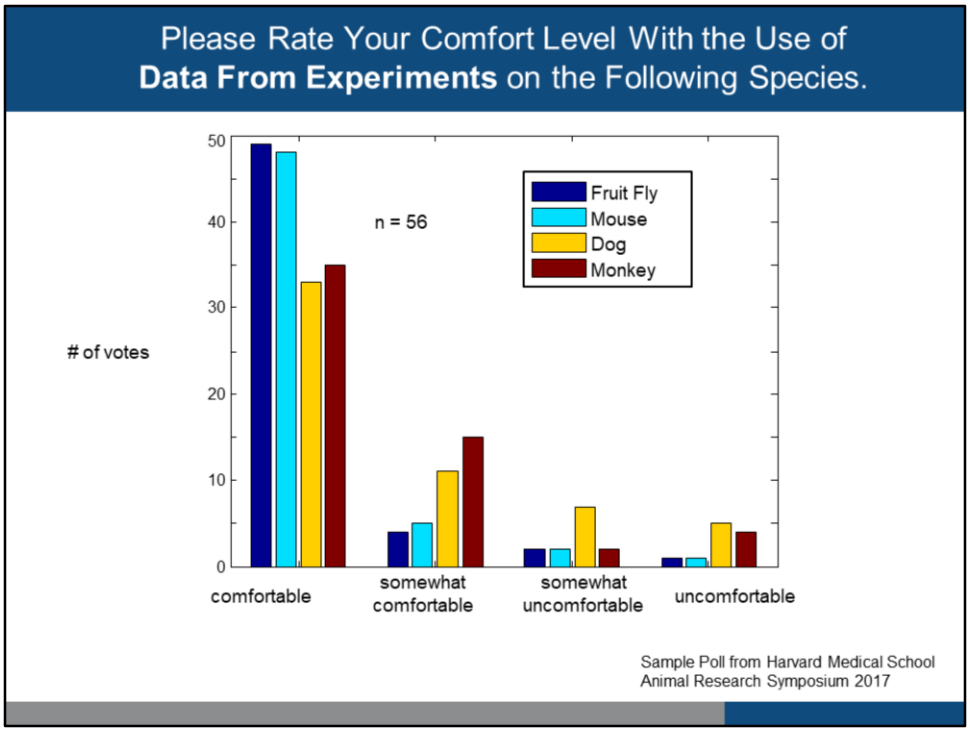
The Role of Animals in Basic, Medical, and Veterinary Health Research

Please Rate Your Comfort Level With the **Prescribing of Drugs Developed and Tested** Using the Following Species





Survey given to Harvard Medical School, Division of Medical Sciences graduate students enrolled in the Conduct of Science Course in October of 2013. Total of 56 respondents.



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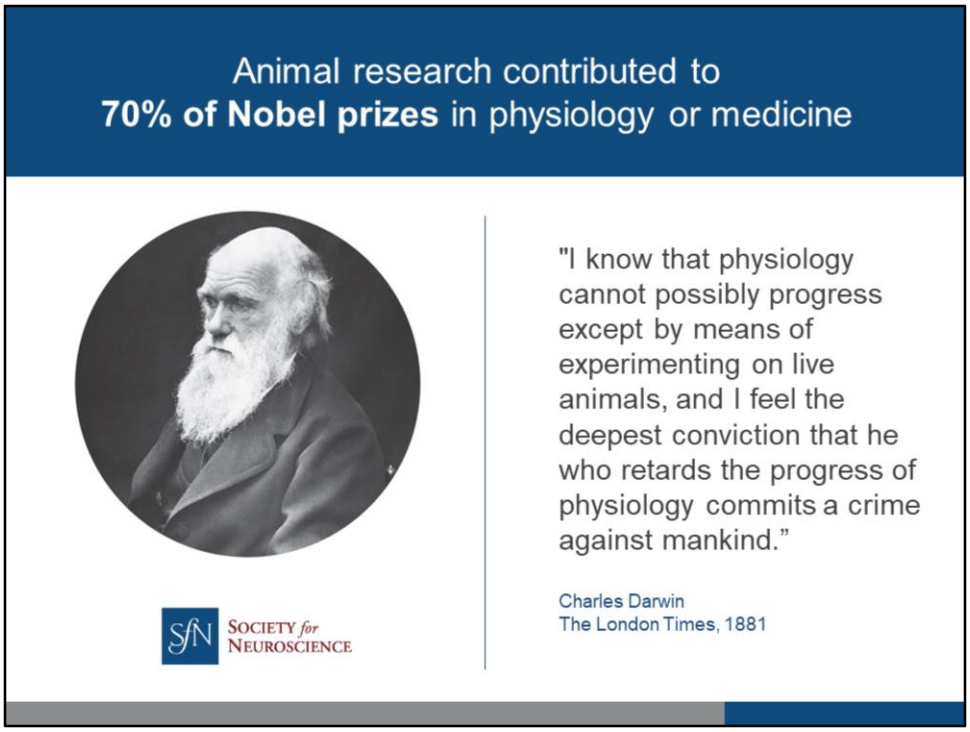


Introduce importance of animal research for medical progress

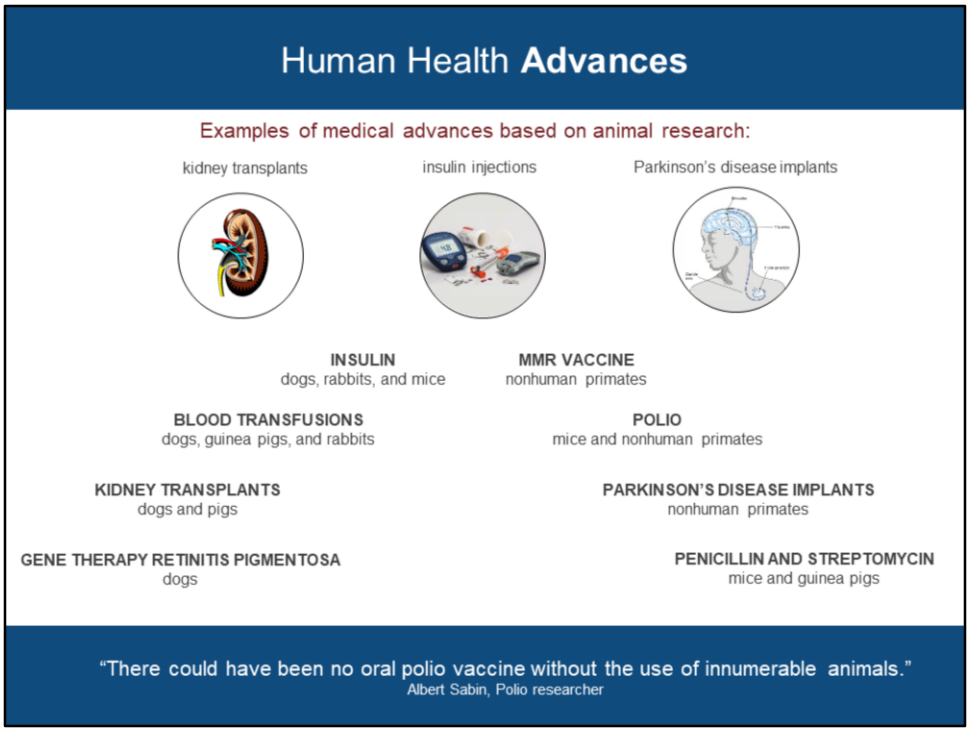
Nobel prize percentage source: https://speakingofresearch.files.wordpress.com/2008/03/medical-advances-and-animal-research1.pdf

Quote source: **Darwin CR.** Mr. Darwin on vivisection. The Times of London 1881;10. as quoted in: Ringach DL. The use of nonhuman animals in biomedical research. Am J Med Sci. 2011 Oct;342(4):305-13. doi: 10.1097/MAJ.0b013e31822a6c35. PubMed PMID: 21817874.

For example, utilizing genetic likeness of animals for scientific progress.

Transgenic animals are useful models to:
- Study disease development
- Evaluate medicines and gene therapies
- Produce and test the purity of human therapeutic proteins

Without animal research, who would lose? Introduce listed beneficiaries: medical advances through animal research help humans, the health of our pets, and provide an understanding of our environment and the interconnectedness / biodiversity of life Pets suffer from many of the same diseases as humans and, thus, benefit from many of the same treatments developed via animal research (e.g., similarities between feline immunodeficiency virus and HIV). Pets' food, medicines, and vaccinations were developed using animal research. For example, many puppies died within months of contracting canine parvovirus until the vaccine was developed via animal research in the early 1980s.

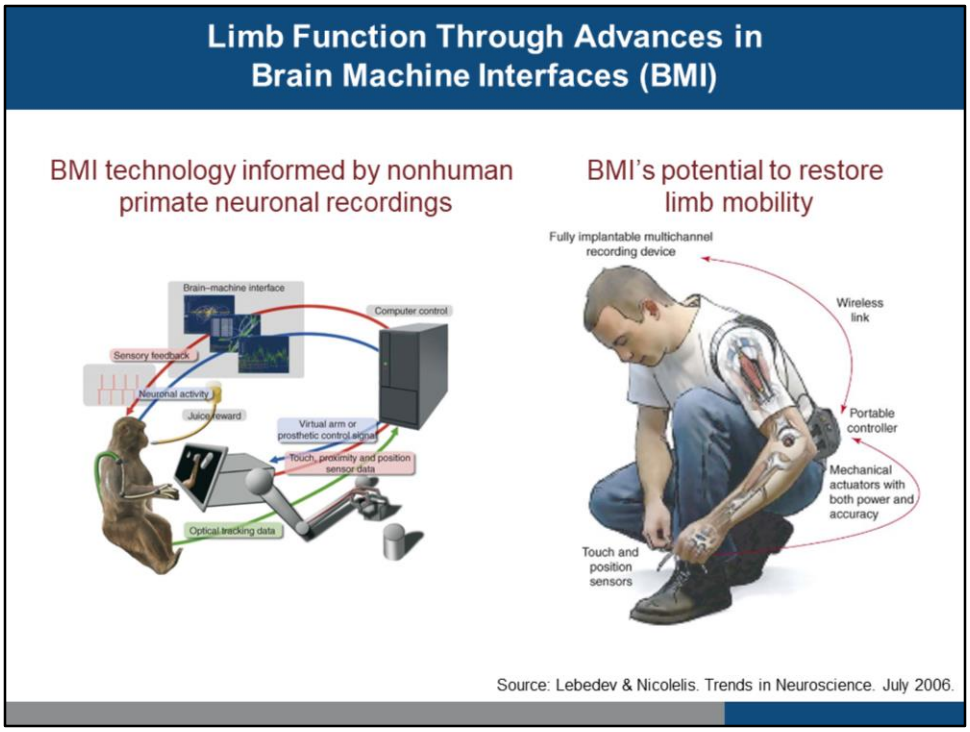


Virtually all medical advances utilized animal research models at some point in the R & D process

Model system used for discovery is listed alongside medical advance

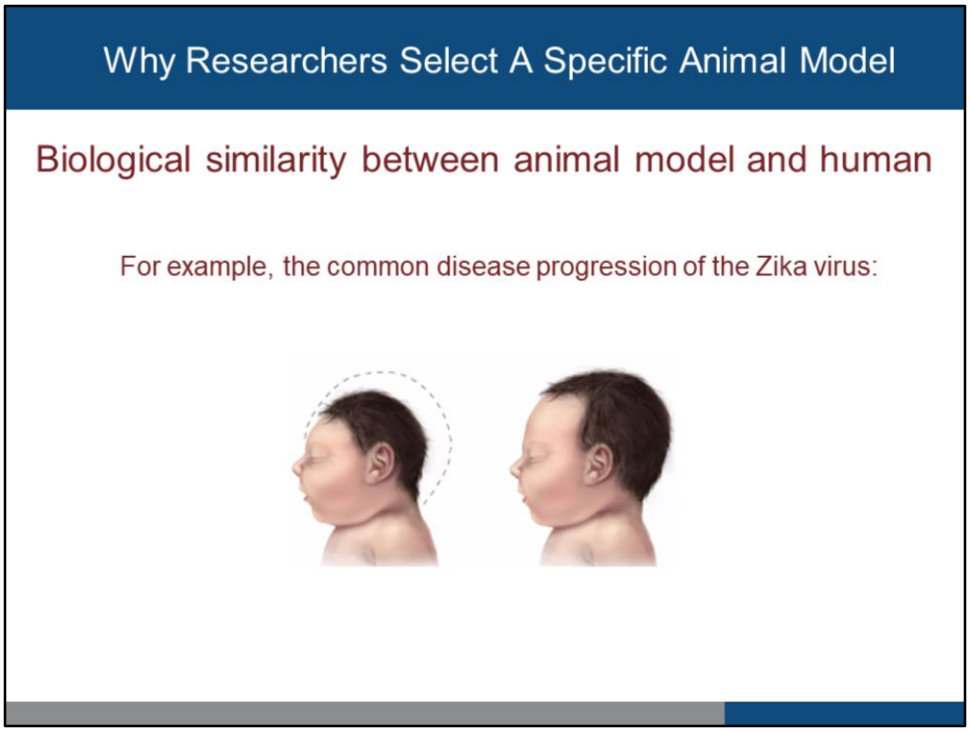
Source: https://speakingofresearch.files.wordpress.com/2008/03/medical-advances-and-animal-research1.pdf

https://speakingofresearch.com/facts/medical-benefits/



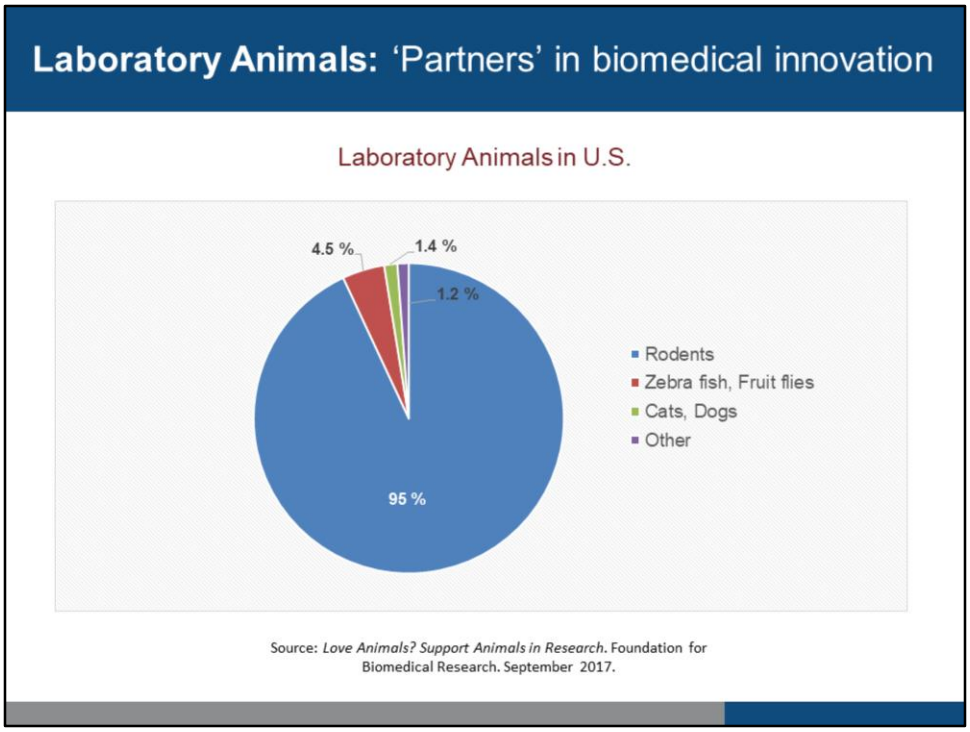
BMI involves a direct connection between the brain areas associated with movement and a wired device like a prosthetic. Neuronal activity is recorded and processed through a computer to power the robotic arm. Feedback from sensors on the arm is converted to micro stimulation of sensory brain areas. BMI aims to generate a prosthetic that feels and acts like a human limb. BMIs may be used as therapy for restoring motor control in disabled individuals. More information can be found at http://www.brainfacts.org/in-the-lab/animals-in-research/2016/animal-research-success-stories-brain-machine-interface-090616

Images from:
http://www.afanporsaber.es/files/homepage/group/loveLAB/love/classes/design/readings/bmi2.pdf



Researchers are working with macaque monkeys to understand the impact of Zika, the latest virus to emerge as a global threat. Zika infection in pregnant women can cause microcephaly, a condition where the child is born with a small head due to abnormal brain development. It also appears to cause stillbirth, miscarriages and fetal growth restriction. These problems all appear to be rooted in how the Zika virus affects the developing fetus and the placenta, which nourishes the baby in its mother's womb. The Zika virus infects monkeys just as it does humans, and both experience the disease in the same way. Researchers can study pregnant monkeys much as an obstetrician follows a woman's pregnancy – they can take blood, monitor fetal development through ultrasounds and collect amniotic fluid. They can then test vaccines and drugs with the hope of protecting the fetus. No other animal model allows for this entire spectrum of study and application of the findings to pregnant women.

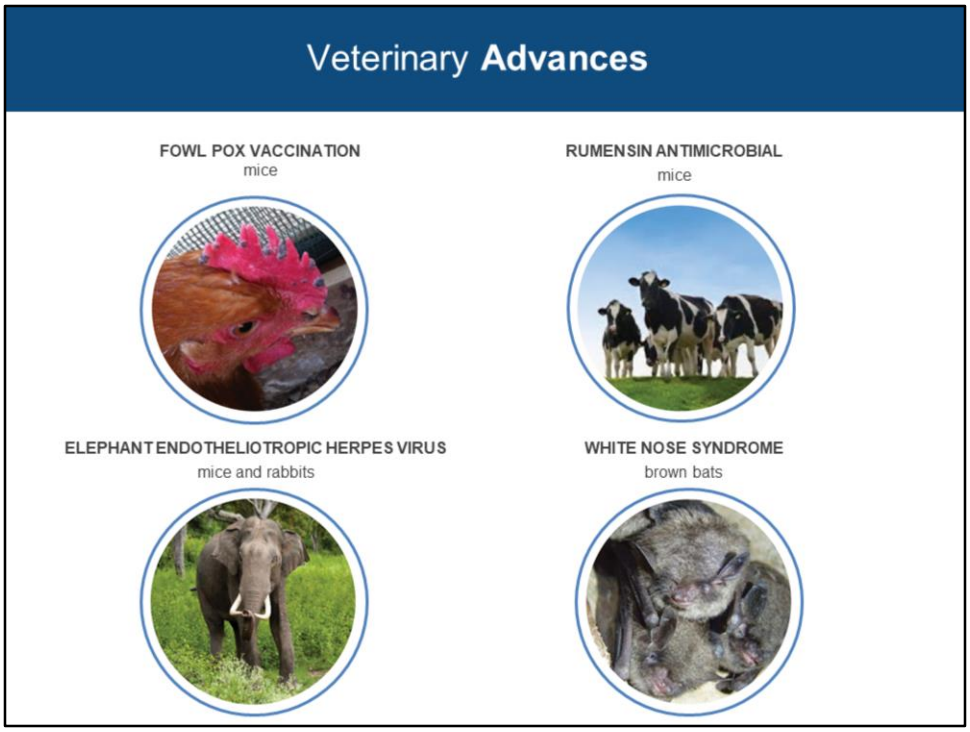
Photo source: FBR (https://fbresearch.org/new-threats-zika-infection-complications-pregnancy/)



The majority of animals in biomedical research are rodents with a small percentage of researchers working with cats, dogs, and NHPs.
Source: *Love Animals? Support Animals in Research*. Foundation for Biomedical Research. September 2017.

Laboratory animals are kept in clean, enriched environments with oversight from veterinarians and behavioral experts.

Photo source: https://nprcresearch.org/primate/NHP-White-Paper-Print-08-22-16.pdf



Through animal research, scientists better understand and have developed treatments for conditions affecting the animal kingdom including diseases affecting pets.

Sources: https://www.wsj.com/articles/love-your-dog-support-animal-research-1505672563; https://fbresearch.org/animal-research-helps-endangered-species/

Model system used for discovery is listed alongside veterinary advance

Fowl pox: virus produces lesions on bird's skin, throat, and trachea; interferes with bird's ability to eat, drink, and breathe normally

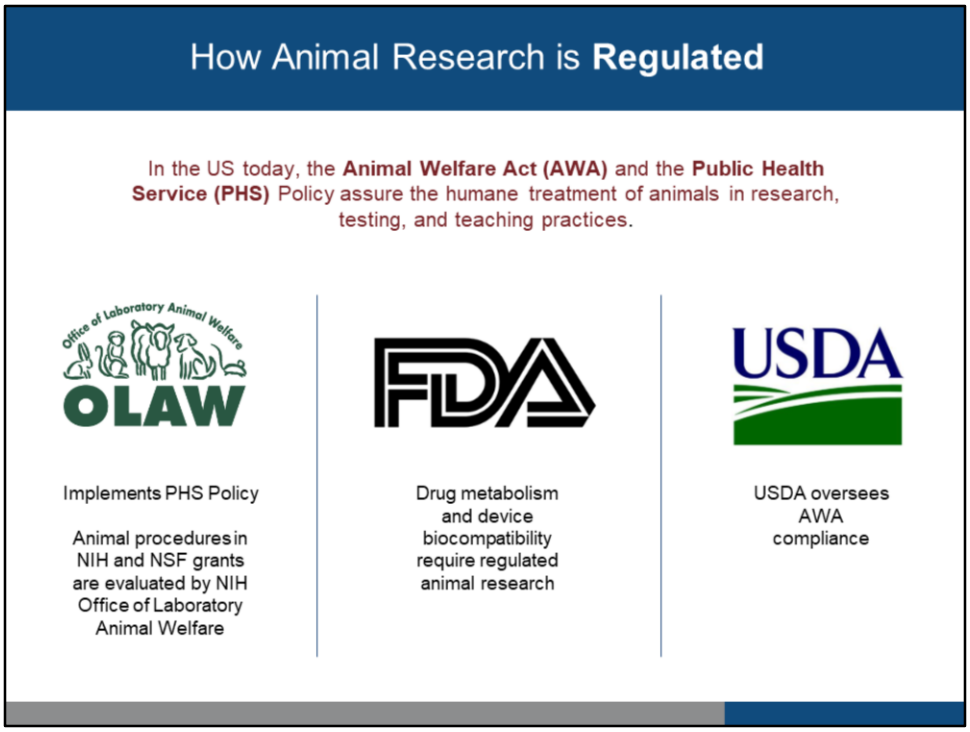
Rumensin: antimicrobial used to prevent and control coccidiosis parasite was originally developed through mouse research

EEHV: Asian elephants are highly susceptible to EEHV, a lethal strain of herpes; studying antibody responses to EEHV proteins in mice and rabbits aims to improve diagnostics and treatments for wild and captive elephants

White nose syndrome: bats' wings are coated in white 'fuzz' during hibernation; fungus affects endangered Indiana and gray bat species; exposed common brown

bats to white fungus to understand disease mechanisms

https://speakingofresearch.com/facts/veterinary-benefits/



Scientists work with laboratory animals in a regulated way as set forth by AWA and PHS.

FDA:
Requires animal research for device and drug approval.
Devices – animal testing is only necessary if new material is used; biocompatibility testing is required
Drugs and Biologics – animal testing is used to determine drug absorption (into blood), drug metabolism, product and metabolite toxicity, speed of metabolite excretion
https://www.fda.gov/AboutFDA/Transparency/Basics/ucm194932.htm

OLAW:
https://grants.nih.gov/grants/olaw/olaw.htm

USDA:
https://www.nal.usda.gov/awic/animal-welfare-act

Regulations Governing Animal Research

Animal Welfare Act (AWA) and the **Public Health Service (PHS) Policy** require each research institution to appoint an **Institutional Animal Care and Use Committee (IACUC)** including a veterinarian and a non-affiliated public representative to review all experimental protocols, inspect facilities, and suspend any research practice not in compliance

SfN Society for Neuroscience

In IACUC proposals, scientists must…

1. Cite literature to explain:
   - Why their model is the **appropriate experimental subject** to address the research question
   - Why **alternative research subjects** (e.g., cell culture and computer simulation) would not yield similar information
   - Why their potential results would not **unnecessarily duplicate** previous research
2. Perform sample size calculations to determine **number of animals necessary**

Many institutions are implementing animal research conduct by following the 3 R's:

- Replace with an alternative
- Refine methods to minimize pain and invasiveness
- Reduce the number of animals

Each research institution oversees individual laboratories' practices through an IACUC. The IACUC requires researchers to justify their work with animals and their use of the 3 Rs.

Above source: https://www.darwinproject.ac.uk/commentary/life-sciences/darwin-and-vivisection

Below source: http://www.nabr.org/animal-welfare-2/animal-welfare-in-practice/functions-of-the-iacuc/

https://speakingofresearch.com/facts/research-regulation/

Animal Research **Resources**

Foundation for Biomedical Research

Animals behind the 25 most prescribed drugs

Species-specific examples of animal research:
1. Rodents
2. Dogs
3. Cats
4. Nonhuman primates

Americans for Medical Progress

Come See Our World video

Love Care Progress
nonhuman primate video

Federation of European Neuroscience Societies

Speaking of Research

Association for Assessment and Accreditation of Laboratory Animal Care International

Please utilize these resources for additional information.