

# ANIMAL CARE AND USE

Authored by  
**mohammad looti**

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## ANIMAL CARE AND USE

**Primary Disciplinary Field(s):** Bioethics, Biomedical Research, Psychology, Veterinary Medicine, Institutional Compliance

### 1. Core Definition and Scope

Animal Care and Use (ACU) refers to the comprehensive body of ethical standards, institutional policies, and governmental regulations designed to govern the procurement, housing, husbandry, experimental manipulation, and ultimate disposition of non-human animals utilized in scientific research, testing, and educational activities. ACU is fundamentally rooted in the recognition of animal sentience and the corresponding moral obligation of the scientific community to minimize pain, suffering, and distress associated with their use. This framework mandates that all procedures involving animals must be both scientifically necessary and ethically justified, operating under stringent protocols aimed at ensuring the highest possible standard of humane treatment.

The scope of ACU extends far beyond simple procedural guidelines; it encompasses the entire ecosystem in which laboratory animals exist. This includes meticulous oversight of housing conditions, sanitation protocols, nutritional provisions, environmental enrichment designed to mitigate stress, and comprehensive veterinary care throughout the animal's lifespan within the research facility. Compliance with ACU regulations is typically a mandatory condition for institutions seeking federal funding for research, particularly from major bodies such as the National Institutes of Health (NIH) or the Public Health Service (PHS), thereby transforming ethical adherence into a critical component of institutional scientific infrastructure.

Furthermore, ACU protocols ensure accountability through mandatory documentation and reporting. Every experimental protocol must be rigorously reviewed and approved prior to initiation, detailing the justification for the species chosen, the number of animals required, and the steps taken to prevent or alleviate pain. This continuous cycle of review, inspection, and refinement guarantees that the commitment to humane practices is actively maintained and adapted to evolving scientific understanding and ethical expectations regarding animal welfare.

### 2. Regulatory Frameworks: The Foundation of Ethical Practice

The contemporary structure of Animal Care and Use in the United States is anchored by two principal regulatory pillars: the 1966 Animal Welfare Act (AWA), enforced by the U.S. Department of Agriculture (USDA), and the Public Health Service (PHS) Policy on Humane Care and Use of Laboratory Animals. The AWA, originally enacted by Congress in 1966 and notably amended in 1990 to provide explicit consideration for the psychological well-being of non-human primates, establishes minimum standards for handling, housing, feeding, and veterinary care for certain warm-blooded animals used in research. The Act requires institutions to register with the USDA

and undergo periodic, unannounced inspections to ensure compliance.

The PHS Policy, mandatory for any entity receiving federal funding from agencies like the NIH or the Centers for Disease Control and Prevention (CDC), often imposes standards that exceed those outlined in the AWA. This policy relies heavily on the guidance provided by the Guide for the Care and Use of Laboratory Animals, first published in 1968 and regularly updated, which serves as the internationally recognized benchmark for optimal animal husbandry and procedural standards. Institutions adhering to the PHS Policy must receive an assurance from the Office of Laboratory Animal Welfare (OLAW) confirming their commitment to the detailed standards of the Guide.

The synergy between the AWA and the PHS Policy creates a robust system of overlapping oversight. While the AWA focuses on facility standards and specific species (though controversially excluding purpose-bred rats, mice, and birds, which constitute the majority of animals used), the PHS Policy enforces adherence to the Guide's high standards across virtually all federally funded research. This comprehensive regulatory landscape ensures that the ethical use of animals is not a matter of voluntary choice but a mandatory legal and administrative requirement foundational to modern scientific research integrity.

### **3. The Institutional Animal Care and Use Committee (IACUC)**

The operational nucleus of the ACU framework within any research institution is the Institutional Animal Care and Use Committee (IACUC). Mandated by both the AWA and the PHS Policy, the IACUC is charged with the direct oversight and evaluation of all aspects of the institution's animal program. The committee must be composed of a diverse group of individuals, including at least one veterinarian with experience in laboratory animal medicine, at least one practicing scientist experienced in animal research, and, crucially, at least one public member who is not affiliated with the institution and represents the general community interests in animal welfare.

The primary function of the IACUC is the detailed review and approval of all protocols proposing the use of live vertebrate animals. This review process involves a rigorous assessment of the scientific merit of the project, the necessity of using animals, the appropriateness of the species and number requested, and the methods proposed to minimize pain and distress. The committee has the authority to approve, require modifications in order to approve, or withhold approval of any activity involving animals, serving as the gatekeeper for ethical research practices.

Beyond protocol review, the IACUC is responsible for regular inspection and monitoring of the animal facilities and research sites. Semi-annual site inspections are required to ensure that housing conditions meet regulatory standards and that personnel are adequately trained. Furthermore, the committee investigates any concerns or complaints reported regarding the misuse or mistreatment of animals. This continuous, internal monitoring process ensures proactive compliance and provides a mechanism for immediate intervention should ethical or welfare

standards be compromised.

#### 4. The Principle of the Three Rs: Replacement, Reduction, Refinement

Modern ACU philosophy is fundamentally guided by the ethical paradigm known as the Three Rs: Replacement, Reduction, and Refinement. This concept, initially articulated by zoologists William Russell and Rex Burch in their 1959 book, *The Principles of Humane Experimental Technique*, serves as the ethical compass for minimizing animal use while maximizing scientific yield and animal welfare. The three components are hierarchical and interdependent, driving innovative approaches in biomedical science.

**Replacement** is the obligation to substitute conscious, sentient animals with non-sentient alternatives whenever scientifically feasible. This involves prioritizing the use of *in vitro* models (cell cultures, organ-on-a-chip technologies), computer modeling and simulation (computational biology), and advanced human clinical data when answering specific research questions. Total replacement, while the ultimate ethical goal, remains challenging for complex physiological studies, but partial replacement strategies, such as using invertebrates (which may fall outside strict regulatory oversight) instead of vertebrates, are increasingly common.

**Reduction** mandates that researchers use the fewest number of animals necessary to obtain statistically valid results. This principle drives the requirement for rigorous experimental design, including power analyses, pilot studies, and the application of advanced statistical methodologies that maximize the data retrieved from each individual animal. Avoiding unnecessary duplication of experiments through effective data sharing and literature review is also a critical element of fulfilling the reduction principle.

**Refinement** focuses on minimizing pain, suffering, and distress for all animals still required for research. This includes improving housing environments (e.g., providing species-appropriate enrichment, social housing), enhancing veterinary care (proactive analgesia and anesthesia protocols), and developing less invasive experimental techniques. Refinement also extends to the training of personnel to ensure all handling and procedures are performed swiftly and skillfully, thereby reducing stress and procedural discomfort.

#### 5. Standards of Humane Treatment and Minimization of Suffering

The core directive of ACU standards, reiterated in the initial source content, is the absolute necessity that the suffering of animals be minimized when used in research. This minimization is achieved through adherence to prescriptive standards governing every aspect of the animal's environment and experimental manipulation. Housing standards, for instance, are meticulously detailed, specifying cage size, temperature, humidity, lighting cycles, and air quality, often exceeding basic maintenance requirements to promote psychological well-being. Furthermore,

social animals, such as non-human primates and certain rodents, must be housed in ways that promote social interaction unless scientifically justified isolation is necessary and approved by the IACUC.

Veterinary oversight is integral to minimizing suffering. A dedicated laboratory animal veterinarian must be involved in planning experimental protocols, particularly those involving surgical procedures, post-operative care, and administration of potentially painful stimuli. Comprehensive analgesic plans must be in place, ensuring that pain relief is provided before, during, and after any procedure classified as painful, unless withholding analgesia is scientifically unavoidable and explicitly justified and approved by the IACUC.

In cases where an animal is expected to experience chronic pain, distress, or morbidity that cannot be alleviated, or upon reaching predetermined endpoints (criteria for removal from study), humane euthanasia is required. The methods of euthanasia must comply with the recommendations published in the American Veterinary Medical Association (AVMA) Guidelines for the Euthanasia of Animals, ensuring a rapid, painless, and stress-free process. This final step underscores the commitment of ACU to end suffering when scientific utility has been exhausted or animal welfare has been critically compromised.

## **6. Ethical Justification and the Cost-Benefit Analysis**

A fundamental requirement embedded within the ACU review process is the mandatory ethical justification of the proposed research. This justification necessitates a robust cost-benefit analysis conducted by the IACUC, weighing the potential societal benefits (e.g., medical breakthroughs, safety testing results) against the unavoidable costs imposed on the animals (pain, distress, deprivation, and eventual death). The determination must be made that the scientific knowledge to be gained is of sufficient magnitude and unique necessity to warrant the use of sentient beings.

This ethical calculus demands that researchers demonstrate that they have thoroughly reviewed existing literature to ensure the study is not duplicative and that no appropriate alternative methodology exists (the principle of Replacement). Furthermore, they must demonstrate that the experimental design is optimized (Reduction) and that all possible measures have been taken to reduce suffering (Refinement). If the IACUC determines that the scientific aims are trivial, the methods are flawed, or the level of distress is excessive relative to the anticipated benefit, the protocol must be rejected or significantly modified.

The ethical burden of ACU protocols often requires scientists to justify procedures that would otherwise be considered unacceptable. For example, procedures classified as Category D or E (involving painful stimuli or requiring withholding of analgesic agents to measure pain response) are subjected to the highest level of scrutiny. The institutional commitment to ACU therefore serves as a formal contract between the research community and society, ensuring that animal sacrifice is

undertaken only in pursuit of significant human or animal benefit, and under conditions of maximal humane consideration.

## 7. Debates, Criticisms, and Future Directions

Despite the extensive regulatory structure of Animal Care and Use, the field remains a subject of intense ethical and political debate. Critics often point to inherent limitations in the existing legal frameworks. A primary criticism is the significant exclusion of purpose-bred rats, mice, and birds from the protections of the AWA, which leaves the welfare of the vast majority of research animals dependent solely on institutional adherence to the PHS Policy and the voluntary commitment to the Guide. Advocacy groups continually pressure legislatures to extend AWA protections universally.

Furthermore, defining and measuring "minimization of suffering" remains a highly subjective challenge. While ACU mandates refinement, assessing subtle psychological distress, chronic pain, or the cumulative effects of multiple procedures over time is inherently difficult. Critics argue that the IACUC structure, being internally composed, suffers from potential conflicts of interest, whereby the pressure for scientific output may inadvertently overshadow the strict enforcement of welfare standards. This has led to calls for greater independence and public transparency in IACUC operations.

The future direction of Animal Care and Use is driven largely by technological advancements and renewed ethical commitments to the Three Rs. Significant resources are currently being invested in developing advanced non-animal models, such as human-relevant organoids and sophisticated *in silico* toxicology screens, aimed at achieving true Replacement in areas like drug testing and safety evaluation. As scientific capabilities evolve, ACU standards are expected to become increasingly stringent, pushing institutions toward minimizing animal use, while simultaneously demanding higher quality of life for the essential animal models that remain required for complex biological research.

### Further Reading

[Animal Welfare Act \(AWA\)](#). U.S. Department of Agriculture (USDA).

[Guide for the Care and Use of Laboratory Animals \(8th Edition\)](#). National Research Council.

[Public Health Service \(PHS\) Policy on Humane Care and Use of Laboratory Animals](#). Office of Laboratory Animal Welfare (OLAW).

[The Three Rs \(Replacement, Reduction, Refinement\)](#). Wikipedia Entry.

[Institutional Animal Care and Use Committee \(IACUC\) Overview](#). OLAW.