AAOS American Academy of Orthopaedic Surgeons
American Association of Orthopaedic Surgeons

Position Statement

Animals in Biomedical Research and Education

This Position Statement was developed as an educational tool based on the opinion of the authors. It is not a product of a systematic review. Readers are encouraged to consider the information presented and reach their own conclusions.

The American Academy of Orthopaedic Surgeons (AAOS) is committed to ensuring humane treatment of animals used for laboratory research or surgical education. Government agencies, accrediting agencies, and research institutions must monitor activities within the current laws and guidelines, and individual investigators must increase their sensitivity and discrimination in the use of animals for these purposes.

This position statement asserts that the appropriate use of animals in conducting biomedical and veterinary research and education is justified to enhance the quality of life for both humans and animals. Numerous medical advances, many of which today are taken for granted, were the results of research that required the use of animals. The development of insulin, for example, was critically dependent upon animal experimentation. The development of novel chemotherapeutics routinely requires such experimentation to establish efficacy and safety for use in humans and animals. Improvements in internal fixation of fractures, often life-threatening in animals, have also relied upon animal models of fracture repair.

The AAOS believes federal, state, accrediting agency, and local institutional guarantees and protections provide an appropriate framework for current animal research.

The Animal Welfare Act of 1966 as amended by the Food Security Act of 1985 (PL 99-198), the Health Research Extension Act of 1985 (PL 99-158), the National Institute of Health Guide for the Care and Use of Laboratory Animals (revised 2011), and the Public Education Health Service Policy on Humane Care and the use of Laboratory Animals by Awardee Institutions (revised 2002) provide excellent protections against the misuse or abuse of animals for research purposes. Additionally, the American Association for Accreditation of Laboratory Animal Care ensures that accredited care facilities meet reasonable and appropriate guidelines for the care of animals. Federal law requires each institution to have a local committee that reviews and assesses the appropriateness of all projects requiring animal experimentation. Peer review groups at granting institutions also provide another level of review of appropriate animal use and further protections. Appropriate use of these laws and guidelines will ensure that alternatives to animal experimentation have been first explored, that minimal numbers of animals and appropriate species have been chosen, that the experiments will answer meaningful questions, and that the animals are being treated in a caring and humane way.

The AAOS believes and encourages investigators employing experimental protocols involving laboratory animals to carefully consider the appropriateness and sensitivity of the protocols prior to choosing and using live animals.

The "3Rs" should be considered before investigators adopt an animal-based experimental protocol. **Replace** animal subjects with nonsentient organisms such cell or tissue cultures, or with an inanimate model such as a bench or computer simulation; **reduce** the number of sentient animal subjects by carefully designing and conducting experiments in a manner that produces reliable and statistically significant results, eliminating the need for repetitive confirmatory tests; or refine clinical protocols to reduce the incidence or severity of distress experienced by laboratory animals.

The above approaches, however, do and will continue to have common and particular inherent limitations. It is clear that cells and tissues in culture do not behave entirely like cells in the intact organism. It is also clear that bench and computer simulations do not always serve as sufficient proxies for "live" surgical intervention and that they must always be validated through some sort of animal or human behavior before they can achieve wide use.

Examples can be cited in which research studies depend on animal models because they permit in vivo study of the interaction of many tissue and organ systems:

- *The study of skeletal infection and pharmacokinetics - the interaction between antibiotics and infectious organisms can be quite different in a living animal and in a laboratory environment.*
- *Fractures of long bone and soft tissue injury and repair - the repair process involves many tissues and our current knowledge of these interactions is incomplete. Laboratory or experimental models do not provide the complex interactions required to adequately observe the repair process.*

The AAOS believes research funds should be allocated within governmental and private research agencies to support the development of alternative approaches to animal research.

Current funding policies tend to favor biomedical research that addresses specific clinical problems, rather than research that develops and explores alternative experimental methods. Additional funding specifically aimed at developing alternative approaches to animal experimentation is warranted at this time. The AAOS has provided resources and continues to be supportive of these ongoing efforts.

The AAOS believes that animal models, in specific circumstances, can be used for surgical education and refinement of new surgical techniques.

Coronary bypass surgery and organ transplantation are two examples of numerous instances in which surgical techniques were developed and perfected in animals and later adopted as standard of care in humans. More recently, endoscopic technologies that have minimized the invasiveness and morbidity associated with open surgery were initially tested and refined using carefully selected animal models. The decision to use live animals for the development and improvement of surgical techniques should be done with caution and only after the proof of concept and feasibility of the procedures have been clearly established. Live animal models should be used for surgical education only when no other means for practical training are sufficient.

The AAOS believes current regulations, restrictions, and guidelines will need periodic review as alternative approaches evolve.

Alternative approaches to animal usage in research and education have changed significantly as they have become more refined and sophisticated, as their limitations have become known, and as new methods have become available. Additionally, increasingly refined, safe, and sophisticated human research has reduced the need for some animal experimentation. In fact, humans continue to be the most common species used for biomedical experimentation and medical education. Thus, current guidelines will need to be periodically updated in light of new methods and alternatives.

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