ANIMAL CARE PROGRAM: ALTERNATIVES

An important ethical principle of animal use in biomedical research is that alternatives to live animals should be used whenever possible. There is a legal requirement for documentation of a search for alternatives and an explanation as to why these alternatives were not found to be suitable or how alternatives were incorporated into the experimental design. The current definition of alternative that has become pervasive in the biomedical research setting is the "3R's": replacement, reduction and refinement.

Replacement means replacing "higher" animals with "lower" animals, or replacing live animals with non-animal models such as dummies, computer simulation or in-vitro systems. Microorganisms, plants, eggs, fish, amphibians, reptiles and invertebrates may be used in some studies to replace warm-blooded animals. (NIH website on Model Organisms for Biomedical Research) Alternatively, live animals may be replaced with non-animal models, such as dummies or mechanical or computer models, (ILAR Journal Computational Models) audiovisual aids, or in-vitro modeling.

> **Advantages** of replacement include utilizing pre-existing knowledge for teaching, applying known principles to new systems to look for similarities, and using less expensive animals or models to screen large numbers of agents for toxicity or mutagenicity.

> **Disadvantages** to replacement chiefly stem from the fact that any models are dependent on pre-existing information. In a system as complex as a live organism, all of the variables in physiology and pathology are not known. Thus, any research on new biological processes must utilize a living organism at some point.

Reduction means minimizing the number of animals needed to perform an experiment or teach a concept. Methods to achieve this include:

- Performing pilot studies to determine some of the potential problems in an experiment before numerous animals are used

- Designing a study to utilize animals as their own controls

- Gathering a maximum amount of information from each animal, perhaps gathering data for more than one experiment concurrently

- Consulting with a statistician to use only the numbers of animals required to achieve significance; (Link to on-line statistical resources) (ILAR Journal Statistical Approach to Calculation the Minimum Number of animals Needed in Research)

- Minimizing variables such as disease, stress, diet, genetic, etc. that may affect experimental results

- Performing appropriate literature searches and consulting with colleagues to ensure that experiments are not duplicated

- Using the appropriate species of animal so that useful data is collected

Refinement means refining experimental protocols to minimize pain or distress whenever possible. Examples of refinement include:

- Identifying pain and distress and making plans for preventing or relieving it.

- Setting the earliest possible endpoint for the experiment. That is, if the necessary information can be gathered before the animal experiences any ill effects from the experiment, this should be defined as the endpoint and the animals subsequently euthanized

- Receiving adequate training prior to performing a procedure

- Using proper handling techniques for animals

- Ensuring that drug doses are correct and that drugs are not expired

- Ensuring that procedures to be performed on the animal are reasonable for that species

- Using appropriate analgesics and anesthetics for potentially painful procedures

- Performing surgeries and procedure aseptically to prevent infection

- Performing only a single major survival surgery on any one animal whenever possible

- Performing appropriate post-surgical care, including thermoregulation and fluid balance

Searching for Alternatives

The animal protocol form asks for methods used to search for alternatives to animal use and to procedures which may cause more than slight pain or distress to animals. Examples of these would be a literature search (indexes searched and keywords used should be listed), consultation with peers in the field, and consultation with the National Agricultural Library's Animal Welfare Information Center (described below) or the Johns Hopkins Center for Alternatives to Animal Testing (see below).

[Guidance document from USDA on alternative searches]

Resources available to assist in searching for alternatives:

- [The Animal Welfare Information Center](#) (part of the National Agricultural Library)

- [Animal Welfare Institute (AWI)](#)

- [The Johns Hopkins Center for Animal Alternatives](#)

- [National Library of Medicine](#)

- [Netvet](#)

- [HotBot](#)

- [Altavista](#)

- [Metacrawler](#)

- [National Centre for the Replacement, Refinement and Reduction of Animals in Research's (NCR3) Information Portal](#)