Use of Novel Compounds

Summary/Purpose: To establish measures that help ensure justification of animal numbers and PI and IACUC oversight of pain and distress in drug discovery research.

I. Rationale

Unlike traditional hypothesis testing, drug discovery research on novel compounds 1) cannot always predict precisely how many compounds will be tested in a protocol and, therefore, cannot always predict the numbers of animals required; and 2) cannot always predict adverse effects that could produce pain or distress in animals. The purpose of this policy is to establish measures that help ensure justification of animal numbers and Principal Investigator (PI) and Institutional Animal Care and Use Committee (IACUC) oversight of pain and distress in drug discovery research.

II. Definitions

A. Novel Compound

A Novel Compound is any chemical entity that 1) has never been tested in animals; or 2) is in preliminary stages of animal testing. Novel Compound status affects the evaluation of a compound for potential for adverse side effects and the animal monitoring intensity level. Novel Compound status will continue until the PI has collected a reasonable amount of data from observing animals at the maximum dose of a novel compound. If, at this stage, no adverse effects have been found, formal monitoring can cease. If adverse effects have been found, formal monitoring will continue at a level necessary to prevent unnecessary pain or distress.

B. Unanticipated Significant Adverse Effects

Pain and distress may be an unavoidable part of some research protocols (e.g. pain studies, infectious disease models). Guidelines pertaining to these types of studies already exist in the current protocol application. This policy seeks to address unanticipated pain and distress that occurs as a result of administering substances with unknown effects on animals. Examples of Unanticipated Significant Adverse Effects include lethality, substantial weight loss, and collapse.

III. Background to Justification of Number of Animals

Identification of novel compounds of interest occurs continuously but at varying rates in drug discovery laboratories. PIs test large numbers of novel compounds annually (e.g. 80-100) in search of drugs to cure disease, but the number of compounds that will be used for testing can rarely, if ever, be specified in advance. This prevents PIs from stating precisely the number of animals required in IACUC applications. However, based on the estimated number of compounds, and using an appropriate justification formula (see The University of Mississippi V.B.1. below), PIs can estimate the number of animals required...
per compound, and the IACUC will accept that estimate. The IACUC will monitor the justification formula through the annual update process: PIs will submit the number of compounds and number of animals used for the year on the standard Protocol Annual Update Form.

IV. Background to Recognition of and Minimizing Pain and Distress

Most novel compounds are pre-screened for the biological activity of interest and for toxicity through in vitro tests. However, in some cases in vitro tests correlate very poorly with in vivo results. Also, in many cases the animal model used to test the novel compound introduces known diseases and/or drugs that have significant pain or distress profiles. In contrast, novel compounds are developed with the aim to have no adverse effects.

Drug discovery procedures often have pilot research strategies built in. Initially, only a very few animals receive each dose of a novel compound. If Unanticipated Significant Adverse Effects are seen at higher doses, testing of those doses is terminated (unless scientifically justified).

Pain and distress concerns about novel compounds are dealt with in this policy in two ways. First, PIs indicate how prior in vitro or in vivo data (if available) will be used to estimate potential for adverse side effects and to determine initial dose. Second, PIs submit a plan for monitoring adverse effects. This plan includes a determination of humane endpoints (see V.C.3. below).

V. Procedures

A. Compounds Names and Structures

The names and structures of compounds are not required in protocol applications.

B. Justification of Numbers

1. PIs will provide numbers of animals/treatment/procedure. If the number of Novel Compounds to be tested cannot be determined at the time of submission, PIs will provide the best estimate of compounds and animals needed.

2. Animal numbers will be tracked and reviewed for justification through the Protocol Annual Update Form.

C. Evaluation and Observation of Pain and Distress

1. Compound effects

The PI should provide the following information in the protocol application:
a. Indicate which of the 3 following classes applies to the compound(s). (Appropriate literature or structure searches should be included to determine class [provide search strategy]. This information should be provided in Appendix VII.)

1. *In vitro or in vivo* data exist and indicate no known toxicity.
2. *In vitro or in vivo* data exist and indicate probable toxicity. This information can come from testing the compound in question or compounds with similar structure. It may include information such as chemical class (stimulant, depressant, etc.), mechanism/site of action, or cytotoxicity. The PI should submit this information with the protocol application.
3. There are no *in vitro or in vivo* data available to the PI.

b. Describe and indicate how the following are determined: the initial dose and route of administration to be used; the intervals for increasing the dose (e.g. half log); any reasons for deviating from this plan; the rationale for target dose (e.g. adverse effects and/or dose needed to treat the disorder). If compounds are unavailable at the time of initial protocol application, indicate the decision tree that will be used to determine initial dose, intervals, route of administration, increments of increasing doses, reasons for deviating from this plan, and rationale for target dose for each of the three classes described in C.1.a above.

c. Provide a plan for monitoring for adverse effects in test animals. This plan should include a checklist of signs of pain and distress relevant to the species, any anticipated signs based on known information, and frequency of monitoring. (If the PI has collected a reasonable amount of data from observing animals at the maximum dose of a novel compound and no adverse effects have been found, formal monitoring can cease. If adverse effects have been found, formal monitoring should continue at a level necessary to prevent unnecessary pain or distress.)

d. Examples:

1. If compounds for which there is no information suggesting adverse Effects are developed, a standard initial dose (defined here by PI) would be used; animal monitoring can be carried out for a limited amount of time (e.g., 1 hr post treatment).
2. **Notification of Attending Veterinarian**
   The PI will notify the Attending Veterinarian in a timely manner when Unanticipated Significant Adverse Effects are observed. The PI will complete the relevant monitoring sheet and submit a copy of it to the Animal Care Office in NCNPR.

3. **Humane Endpoints**
   Ideally, humane endpoints (predictive signs, indicators of an irreversible deteriorating condition) should be established prior to beginning animal work. Realizing the difficulty in predicting these for studies which involve compounds with unknown adverse effects, the PI should try to develop humane endpoints if severe pain, severe distress, or death is observed. Guidelines should be in place to euthanize animals 1) when humane endpoints are reached, 2) when the study objectives have been realized, 3) if it becomes clear that they cannot be realized, or 4) whenever the degree of suffering is not required or justified by the protocol.

4. **Cooperative Projects**
   In cooperative projects, PIs should make every attempt to obtain or provide information on adverse effects that may be associated with any substance. Often this may be unpublished data collected recently by another PI.

5. **Laboratory Monitoring**
   To better educate the IACUC and to monitor attention to pain and distress, the Attending Veterinarian and one or two IACUC members may observe laboratory procedures under this policy at random intervals. PIs will be consulted in advance.

6. **Pain and Distress Category**
   The pain and distress category of novel compounds will begin at B, unless procedures or anticipated toxicity dictates other categories. As information is acquired about the compound, the category will be changed accordingly.

D. **Record Keeping**

PIs must include the following information in the Protocol Annual Update Form: number of compounds used; number of animals used; number of animals
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categorized as something other than the original pain category; and the number of animals euthanized to achieve the humane endpoint.

All animal monitoring forms should be kept in a location accessible to the Attending Veterinarian and animal care staff. PIs will notify the Veterinarian of Unanticipated Significant Adverse Events and submit a copy of the relevant monitoring sheet to the Animal Care Office in NCNPR.

VI. Additional Points

A. Occupational Health and Safety
The Department of Health and Safety has included unknown compounds in chemical safety training. This training satisfies the occupational health and safety need regarding potentially hazardous unknown agents.

B. Standard Operating Procedures (SOPs)
PIs are encouraged to provide SOPs for procedures involving animals, such as, animal models that will be used for testing the unknowns (e.g. Malaria model, Anxiety model). Once developed and approved, these SOPs can be referred to in new protocol applications. [Note: An SOP is not a protocol substitute.] SOPs should be updated as procedures change. SOPs should be resubmitted for IACUC review every 3 years.

CONTACT US

If you have a question or need assistance, contact Dr. Harry Fyke, Attending Veterinarian, at 915-5324 (hfyke@olemiss.edu), Dr. Larry Shaffer at 281-8153 (lshaffer@northwestms.edu), or Virginia Cantú, IACUC Research Compliance Specialist, at 915-5006 (vcantu@olemiss.edu).