This document has been developed by The Australian National University's (ANU) Research Ethics Office. It has been endorsed by the ANU Animal Ethics Committee (AEC). It is designed to provide guidance regarding current best practice to institutional animal users and carers on the care and use of animals for scientific purposes. It has been prepared in consultation with the Australian code for the care and use of animals for scientific purposes 8th edition 2013 (updated 2021).

Document 034: Animal Analgesia, Anaesthesia and Surgery Standards V1.0

Background

Good Research Practices

The purpose of these standards is to promote the ethical, humane and responsible use of animals at ANU. By maintaining high standards of animal welfare, we are also ensuring the generation of high quality research through the minimisation of biological variability and improved research reproducibility.

The University recognises that in some instances alterations to standard practice must be made for scientific reasoning, however, where these alterations come with an increased risk to animal welfare, they must be well justified and go beyond the argument that it is consistent with historical approaches or published data.

Definitions

AEC: ANU Animal Ethics Committee. This is a committee convened by the ANU as per the Australian code for the care and use of animals for scientific purposes. The Committee's responsibilities include the review, approval, and monitoring of the use of animals for research and teaching, and assessment of the evidence that the use of animals is justified. The Committee also reviews and approves procedures and guidelines, and provides advice and recommendations to the institution on animal based research.

Analgesia: The absence of pain in response to a stimulus which would normally be painful.

Aseptic Technique: An approach that limits microbial contamination during a surgical procedure.

General Anaesthesia: A drug induced loss of consciousness, preventing the perception of pain while the animal is unconscious.

Major Surgical Procedure: Surgery that exposes a body cavity or any procedure that permanently impairs physical or physiological functions (e.g., laparotomy, thoracotomy, craniotomy, amputation).

Surgical Procedure: A surgical procedure is one that requires the incision of living tissue. In the scientific setting, the type of procedure will depend upon the scientific purpose but can range from a superficial cut-down to the penetration and exposure of a body cavity or extensive tissue dissection.

Survival Surgery: A procedure where an animal recovers (regains consciousness) after surgery.

The Code: Refers to the Australian code for the care and use of animals for scientific purposes, 8th edition 2013 (updated 2021).

Terminal, acute, or non-survival surgery: Animal is humanely killed while still under anaesthesia (that is, it does not regain consciousness once anaesthetised).

General Information and Considerations

Species Differences

There are considerable differences between species in regards to: drug metabolism, thermoregulation, pain perception, physiological function, and anatomy. These species differences will affect the selection of analgesia, anaesthesia, and surgical protocols and techniques, as well as the support and monitoring required to ensure acceptable welfare outcomes. The age (including developmental stage) and physiological status (eg. animals that are pregnant, diabetic, or have a tumour) of the individual animal will also impact these protocols, and must be considered.

Analgesia should always be considered when developing protocols. As per The Code, "Unless there is evidence to the contrary, it must be assumed that procedures and conditions that would cause pain and distress in humans cause pain and distress in animals."

The Primary Investigator and their team must be aware of the specific needs of the animal(s) they will be undertaking procedures on. Primary Investigators must seek appropriate training if required.

Timing

Animals that undergo anaesthesia or surgical procedures often require additional monitoring, and the availability of research personnel and animal care staff to perform adequate checks and oversight must be taken into consideration. If procedures are undertaken late in the day or at the end of the week, it is the responsibility of the research team to ensure there is adequate monitoring after the procedure as per the approved ethics protocol.

The University requires that no high impact studies with significant risks are undertaken over holiday periods or immediately preceding where support staff are limited. This includes: the four-day weekend over Easter and the University closure period at Christmas. Special approval for any such work must be sought from the ANU Research Ethics Team.

Equipment Availability

If a research group wishes to engage in a program of work that requires anaesthesia and surgery, they must ensure, in advance, that:

A) They have adequate access to the required equipment to meet the standards listed above, and;

B) That the equipment is up to date with any service or maintenance requirements.

Please note that the ANU does not support work undertaken if there is a lack of suitable equipment, as it may jeopardise animal welfare and research quality. A lack of suitable equipment to provide veterinary standard care pre-, during, and post-procedure is not acceptable.

Advice on suitable equipment may be sought from the ANU Veterinary Services Team.

Field Work

The ANU recognises that some work is undertaken in the field and that the delivery of anaesthesia and the maintenance of aseptic standards may be more challenging in these settings. In these instances, it is required that the standards used are similar to those that would be undertaken by a veterinarian in the field. Further advice and training on how to achieve these standards can be sought from the ANU Veterinary Services Team.

Monitoring, Intervention and Reporting

Animal Welfare Risks

Procedures that have the potential to cause pain and discomfort in animals are, by definition, considered to put animal welfare at risk. In addition, the incorrect use of anaesthesia and analgesia can also result in poor animal welfare and poor research outcomes. It is in the best interests of the Primary Investigator and the University to ensure these risks are adequately assessed and mitigated prior to, and throughout, any experimental programs. All researchers performing anaesthesia or surgery must have completed appropriate training and have been deemed competent before working independently.

Surgical procedures come with significant risks to the welfare of animals used. It is a requirement that these risks are identified in the approved animal ethics protocol, along with strategies to minimise the occurrence and impact of these identified risks. All survival surgeries must be performed using aseptic technique. This includes the use of sterile surgical equipment, and the maintenance of a sterile surgical field during procedures. All protocols using major surgical procedures must be reviewed by a person nominated by the AEC; in most instances this will be an ANU veterinarian.

Providing adequate anaesthesia and analgesia, and sufficient monitoring of animals before, during, and after procedures is essential to minimise complications and adverse events. All procedures should use current practices that are recognised by the veterinary profession.

Animals must be appropriately monitored during anaesthesia (until mobile and able to maintain body temperature), and post-Procedure. Post-procedure monitoring must be performed frequently enough to detect complications early, and should consist of the assessment of physiological parameters (eg. body weight, temperature) paired with a method of pain scoring appropriate for the species. See *AEC Approved document_009_Template_Rodent Score system.*

Complications

The ANU recognises that some procedures come with a known element of risk and complication. Such risks must be identified in the approved animal ethics protocol, with measures to mitigate these risks included.

If any complications occur that are not identified and approved, or at a rate higher than expected, then these must be reported to the ANU Research Ethics Team, via the Unexpected Adverse Events Procedure.

In addition, all complications, whether expected or not, should be recorded and available to the ANU Veterinarians for review at any time. This allows for review of common practices and complications, and to assist the University in its continual improvement of animal experimentation.

Minimum Requirements

Analgesia

- When performing any procedure that can potentially cause pain to the animal, an appropriate pain management plan must be in place.
- If analgesia cannot be provided in certain instances due to the specific experiment being performed, this must be justified in the animal ethics protocol, and where pain and distress will not be alleviated, planned endpoints must be put in place as early as feasible.

Anaesthesia

- Standards for the delivery of anaesthesia must be consistent with current veterinary practices. This includes the use of a vaporiser for delivery of inhalational anaesthetic agents and the use of pharmaceutical grade compounds for survival procedures.
- When feasible it is strongly recommended and encouraged that all Anaesthesia procedures are undertaken in a team of two people.

Surgery

- All survival surgical procedures must be undertaken using aseptic technique to minimise the impact on the animal and ensure the generation of high quality research.
- All protocols using **major** surgical procedures must be reviewed by a person nominated by the AEC. In most instances this will be an ANU veterinarian.

Monitoring

- A record of all medications or agents given to an animal must be recorded; including the amount given (by volume and dose rate), the route of administration, the time given, and the person administering the agent.
- Animals under anaesthesia must be monitored throughout, and until they are mobile and able to maintain a normal body temperature. Anaesthetic records must be kept, and investigators may be asked to provide these records to the AEC.
- Post-operative monitoring must be performed frequently enough to ensure that both predicted and unexpected adverse events are identified early, so that they can be addressed rapidly and effectively.

References and Resources

ANU Training and Support for Analgesia, Anaesthesia and Surgery

The Australian Phenomics Facility (APF) provides training for researchers using rodents. Researchers who plan to conduct experiments using anaesthesia and surgery in rodents must complete ANML02 (Introduction to Mouse Care and Handling) and ANML22 (Introduction to Animal Anaesthesia) before commencing experiments. The ANU AEC may waive this requirement for individuals with equivalent training or experience when provided with evidence of competency.

The ANU Veterinary Services Team are available to provide advice on the assessment of pain and methods of anaesthesia and analgesia in different species. This can often be combined with surgical training (including pre-operative preparation, aseptic technique, monitoring and sterilisation of equipment) and approaches to animal care and monitoring.

References

The Australian code for the care and use of animals for scientific purposes 8th edition. 2013 (updated 2021).

Procedure for Managing & Reporting Unexpected Adverse Events.

Further information on managing analgesia and anaesthesia for animals in a research setting can be found in the NHMRC Guidelines to Promote the Wellbeing of Animals Used for Scientific Purposes.

NB It is noted that these guidelines are listed as out of date but the information included is still relevant in many circumstances. Further advice can be sought from the ANU Veterinary Services Team.

Monitoring of pain in animals can be improved with the use of grimace scales as per the NC3Rs publications https://www.nc3rs.org.uk/grimacescales