

## Preface

Research in Hong Kong is well respected. Along with this, the need to ensure that research using animals complies with the internationally accepted concepts of Replacement, Reduction and Refinement in the use of research animals has never been greater or more important.

The Code of Practice for Care and Use of Animals for Experimental Purposes that has been developed by the Animal Welfare Advisory Group and produced by the Agriculture, Fisheries and Conservation Department is one part of the overall strategy being adopted by universities, private research laboratories and the HKSAR Government to better ensure that research being performed in Hong Kong institutions is carried out using animals in a humane manner, with the least number of animals required, and, where possible, using non-animal alternatives.

The Animal Welfare Advisory Group would like to thank Dr Tony James of The Chinese University of Hong Kong and Dr KS Lo of The University of Hong Kong and other members of the team in developing the Code, the members of Animal Welfare Advisory Group for providing advice and guidance and those institutions, individuals and the staff of Agriculture, Fisheries and Conservation Department and Department of Health who provided much valuable input into the various drafts of the Code thereby enabling the production of the final document. It is hoped that this document will be seen as a valuable resource and will be used to ensure that research using animals in Hong Kong is justified and humane.



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# Code of Practice Care and Use of Animals for Experimental Purposes

Animal Welfare Advisory Group  
Agriculture, Fisheries and Conservation Department

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## **SECTION 1 INTRODUCTION**

### **Purpose of the Code**

1.1 The purpose of this Code is to ensure the humane care of animals used for experimental purposes. Its aims are to:

- emphasize the responsibilities of investigators and institutions in using animals;
- ensure that the welfare of animals is always considered;
- ensure that the use of animals is justified;
- avoid pain or distress for each animal used in experimental activities;
- minimize the number of animals used in projects; and
- promote the development and use of techniques which replace animal use in experimental activities.

1.2 The Code establishes Animal Ethics Committees to verify that the case for animal use is justified and to ensure adherence to the principles of Replacement, Reduction and Refinement.

### **Definitions of terms used in this Code**

**Academic institution:** includes universities, university colleges, hospitals, medical schools, agricultural colleges, farm schools, and any other similar institutions.

**Animal:** means a living vertebrate animal.

**Animal Ethics Committee (AEC):** A committee constituted in accord with the terms of reference and membership laid down in this Code of Practice.

**Anaesthetic:** Drugs which are used to render an animal or area of tissue insensible to pain perception.

**Analgesic:** Drugs which are used to reduce nociception.

**Approved project:** A project which has been formally approved by a properly constituted AEC on the basis of a written proposal.

**Death as an end-point:** When the death of an animal(s) is the deliberate measure used for evaluating biological or chemical processes, responses or effects.

**Distress:** An acute or chronic response of an animal caused by stimuli that produce biological stress, which manifests as observable, abnormal physiological or behavioural responses.

**Experiment:** means any procedure (experiment) performed on an animal and calculated to give pain and includes those activities performed to acquire, develop or demonstrate knowledge or techniques in any scientific discipline, including activities for the purposes of field trials, environmental projects, research, diagnosis, product testing, and the production of biological products.

**Euthanasia:** The process of inducing a painless death.

**Investigator:** A person licensed under Cap. 340 and approved by an AEC to be responsible for the conduct of an approved project involving animals.

**Livestock:** Animals which are used in commercial agriculture, including cattle, sheep, pigs, poultry, goats and horses.

**Non-academic institution:** includes any organization that performs experiments on animals but is not an academic institution.

**Proposal:** A written outline of a project put forward for consideration by an AEC.

**Tranquillizers:** Drugs which are used to reduce anxiety or produce sedation.

**Wildlife:** Free-living vertebrates of native, non-indigenous and feral species including captive bred animals and those captured from free-living populations.

## **SECTION 2 GENERAL PRINCIPLES**

2.1 Encapsulated in these principles is the need in experimental activities to consider:

- the replacement of animals with other methods;
- the reduction in the number of animals used; and
- the refinement of techniques used to reduce the impact on animals.

### **Justification**

2.2 Experimental activities using animals may be performed only when they are essential:

- (a) for the purpose of the advancement by new discovery of physiological knowledge, or of any knowledge which will be useful for saving or prolonging life, or alleviating suffering, or for combating any disease whether of human beings, animals or plants;
- (b) for the purpose of testing any former discovery alleged to have been made for the advancement of the types of knowledge referred to in paragraph (a);

2.3 Projects using animals may be performed only after a decision has been made that they are justified, weighing the scientific value of the project against the potential effects on the welfare of the animals.

### **Responsibilities**

2.4 People who use animals for experimental purposes have an obligation to treat them with respect and consider their welfare as an essential factor when planning and conducting projects.

2.5 The acquisition, care and use of animals for all experimental purposes must be in accord with this Code of Practice, and with relevant legislation.

2.6 Investigators have direct and ultimate responsibility for all matters relating to the welfare of the animals they use.

2.7 Investigators must submit written proposals for all animal projects to an AEC which must take into account the expected value of the knowledge to be gained, the justification for the project, and all ethical and animal welfare aspects.

2.8 Experimental activities must not commence until written approval has been obtained from the AEC.

### **Replacement**

2.9 Techniques which replace or complement the use of animals in experimental activities must be sought and used wherever possible.

### **Reduction**

2.10 Projects must be scientifically and statistically valid, and must use only the minimum number of animals necessary.

2.11 The principle of reducing the number of animals used in experimental activities should not be implemented at the expense of the greater suffering of individual animals.

2.12 Experimental activities involving the use of animals must not be repeated unnecessarily.

### **Refinement**

2.13 Animals chosen must be suitable for the purposes of the investigation taking into account their biological characteristics, including behaviour, genetic constitution and nutritional, microbiological and general health status.

2.14 Wildlife should be taken from natural habitats only if animals bred in captivity are not available or are unsuitable for the specific experimental purpose.

2.15 Investigators must use the best available scientific techniques and be competent in the procedures they perform.

2.16 Projects must be designed to avoid pain or distress to animals. If this is not possible, pain or distress must be minimized.

2.17 Pain and distress cannot be evaluated easily in animals and therefore investigators must assume that animals experience pain in a manner similar to humans. Decisions regarding the animal's welfare must be based on this assumption unless there is evidence to the contrary.

2.18 An animal which develops signs of pain or distress of a kind and degree not predicted in the proposal, must have the pain or distress alleviated promptly. If severe pain cannot be alleviated promptly, the animal must be euthanised forthwith. Alleviation of such pain or distress must take precedence over finishing a project.

2.19 Experimental activities which may cause pain or distress of a kind and degree for which anaesthesia would normally be used in medical or veterinary practice must be carried out using anaesthesia appropriate to the species and the procedure.

2.20 Pain management appropriate to the species, the procedure and the circumstances must be provided.

2.21 Analgesic and tranquillizer usage should at least parallel usage in medical or veterinary practice.

2.22 When it is not possible to use anaesthetics or analgesics, such as in certain toxicological or animal production projects or in animal models of disease, the end-point of the experiment must be as early as possible to avoid or minimize pain or distress to the animals.



2.23 Neuromuscular blocking agents must not be used without appropriate general anaesthesia, except in animals where sensory awareness has been eliminated. If such agents are used, continuous or frequent intermittent monitoring of paralyzed animals is essential to ensure that the depth of anaesthesia is adequate to prevent pain or distress.

2.24 Investigators must avoid using death as an experimental end-point whenever possible.

2.25 Experimental activities involving the use of animals must be as brief as possible.

2.26 Animals must be transported, housed, fed, watered, handled and used under conditions which are appropriate to the care of the species. The welfare of the animals must be a primary consideration in the provision of care which should be based on the behavioural and biological needs of the species.

## **SECTION 3 INSTITUTIONS**

### **Responsibilities of institutions**

3.1 Institutions which use animals for experimental purposes must:

- (i) establish one or more AECs directly responsible to the governing body of the institution or its delegate. Where animal usage is small, the institution may access an external AEC;
- (ii) ensure, through the AEC, that all experimental activities involving the use of animals comply with relevant legislation;
- (iii) provide each AEC with facilities, powers and resources to fulfill its terms of reference and operate as set out in section 4;
- (iv) refer to the appropriate AECs for comment on all matters which may affect animal welfare in the institution including the building of, or modification of, animal facilities;
- (v) review annually the operation of each AEC;
- (vi) respond effectively to recommendations from each AEC to ensure that the facilities for the housing, care, use and disposal of animals are appropriate to the maintenance of the health and well-being of the animals;
- (vii) respond promptly and effectively to recommendations from each AEC to ensure that all use of animals for experimental purposes within the institution remains in accord with this Code;
- (viii) upon the advice of the AEC, discipline staff who contravene the Code;
- (ix) provide all relevant staff with details of the institution's policy on the care and use of animals;
- (x) provide staff members with information on potential disease hazards from their work with animals;

- (xi) establish mechanisms to respond to enquiries or complaints concerning the use of animals within the institution and ensure that staff may voice concerns without jeopardizing their employment;
- (xii) establish grievance procedures for AEC members and investigators who are dissatisfied with AEC procedures or decisions;
- (xiii) ensure that the AEC develops guidelines for animal care and use within the institution and that these are implemented, including those which ensure that emergencies are detected promptly and dealt with effectively;
- (xiv) ensure that there are adequate numbers of staff to care for the animals and that they are appropriately trained and instructed;  
and
- (xv) ensure that appropriate veterinary services are available and that there is access to diagnostic services.

## **SECTION 4 ANIMAL ETHICS COMMITTEES**

### **Terms of Reference**

4.1 Terms of Reference of AECs should include provisions to:

- (i) monitor the acquisition, transport, production, housing, care, use and disposal of animals;
- (ii) recommend to the institution any measures needed to ensure that the standards of this Code are maintained;
- (iii) examine and approve, subject to modification, or reject written proposals relevant to the use of animals in experimental activities. Also to approve only those projects for which animals are essential and which conform to the requirements of this Code, taking into consideration ethical and welfare aspects as well as scientific value;
- (iv) formally withdraw approval for any project or authorize the treatment or euthanasia of any animal;
- (v) examine and comment on all institutional plans and policies which may affect animal welfare;
- (vi) maintain a register of approved projects; and
- (vii) perform all other duties required by this Code.

### **Membership**

4.2 An AEC must have a membership which will allow it to fulfill its terms of reference. It must comprise at least four persons, including a separate person appointed to each of the following categories:

*Category A.* A person registered as a veterinary surgeon;

*Category B.* A person with substantial recent experience in the use of animals in experimental activities;

*Category C.* A person who has a commitment to the welfare of animals and who is not employed at the institution;

*Category D.* An independent person who does not currently and has not previously conducted experimental activities using animals, and who is either not an employee of the institution, or someone from the institution who is independent of the departments where medical or scientific research is undertaken.

4.3 The Chairperson should hold a senior position in the institution.

4.4 Before appointment, all members of the AEC should acknowledge in writing their acceptance of the terms of reference of the committee and any requirements for confidentiality required by the institution. The committee should reach agreement on how advice may be sought without breaching confidentiality.

4.5 The AEC may include additional members to assure that the AEC functions effectively, and this may include a person responsible for the daily care of animals within the institution and additional members of category C plus D if required.

### **Written Proposals**

4.6 Written proposals should place before the AEC sufficient information to satisfy the AEC that the proposed use of animals is justified and complies with the principles of Replacement, Reduction and Refinement. The written proposals should:

- (i) be presented in a form that allows the AEC to easily assess information provided. They should be written in a manner that can be understood by all members of the AEC and must identify the impact of all sections of the proposal on animals used and means by which the impact will be minimized.
- (ii) explain the purpose of the experiment, and should fulfill one of the following criteria :

- (a) for the purpose of the advancement by new discovery of physiological knowledge, or of any knowledge which will be useful for saving or prolonging life, or alleviating suffering, or for combating any disease whether of human beings, animals or plants;
  - (b) for the purpose of testing any former discovery alleged to have been made for the advancement of the types of knowledge referred to in paragraph (a);
  - (c) by the order in writing of any judge or district judge in any case where such judge is satisfied that it is essential for the purpose of justice in a criminal case to make such experiment.
- (iii) include the followings :
- (a) any health risks to other animals or staff;
  - (b) a declaration signed by the responsible investigators(s) stating that he or she will perform his or her research according to the Code of Practice, and will abide to the required legislative requirements.

## **Operating Procedures**

4.7 AECs must ensure that operating procedures are established which will enable compliance with the provisions of this Code. Such procedures should cover in particular:

- (i) establishment of a procedure for reaching decisions and such must include responses from at least one member from each Category A, B, C and D. The process by which decisions are made must be fair to investigators, and acceptable to all AEC members;
- (ii) any matter specific to the institution that will assist compliance with this Code; and
- (iii) powers that the AEC is prepared to delegate to an Executive.

4.8 The AEC may establish an Executive which must include at least one external member from Categories C or D. The Executive may approve minor modifications to projects and deal with emergencies, but any decisions by the Executive must be reviewed by the full AEC.

4.9 The Executive may not approve proposals.

4.10 Records must be maintained which record decisions and all other aspects of the AEC's operation.

4.11 Irreconcilable differences between the AEC and an investigator must be referred to the governing body of the institution for review.

### **Assessing proposals**

4.12 Only those experimental activities which conform to the requirements of all relevant sections of this Code and of legislation may be approved.

4.13 Proposals must be considered and approved by the AEC, and signed by the chairperson.

4.14 Decisions on approvals of proposals should be made on the basis of consensus.

4.15 Investigators must be informed of decisions in writing.

4.16 A register of all approved projects must be maintained.

4.17 Decisions must be made as promptly as possible.

4.18 Experimental activities involving the use of animals must not start before written approval is given.

## **Monitoring**

4.19 Inspections of all animal housing and laboratory areas must be conducted regularly by members of the AEC and appropriate records maintained to ensure compliance with the Code.

4.20 AECs must ensure that any activity in breach of this Code ceases immediately and appropriate action is taken. This may include referral to the Head of the institution.

## **Review**

4.21 Approved projects of long duration which last more than 2 years and the long-term continuing use of individual animals which requires holding of the animals for more than six months should be reviewed at an appropriate interval as decided by the AEC.

## **Report to institution**

4.22 The AEC must keep record and report in writing at least annually to the head of the institution or his delegate on:

- numbers and types of projects approved;
- the physical facilities for the care and use of animals within the institution;
- administrative or other difficulties being experienced; and
- any requirements for training staff.

## **Projects at more than one institution**

4.23 Where projects are to be conducted at more than one institution, AEC approval should be sought from each institution unless responsibility has been formally delegated to one AEC.

4.24 When responsibility has been formally delegated to another institution, the investigator should notify the AEC in writing at his/her own institution that there is approval elsewhere for a project.



## **SECTION 5 INVESTIGATORS**

### **General**

5.1 All investigators of a project, including Principal Investigator, subordinate investigator and other members of the team who are performing experiments must be appropriately licensed according to the relevant sections of Cap. 340.

5.2 Investigators have direct and ultimate responsibility for all matters related to the welfare of their animals. They must act in accord with all requirements of this Code.

5.3 The responsibility of investigators extends over all facets of the care and use of animals in projects approved by the AEC. This responsibility begins when the animal is allocated to the approved project and ends at the time of disposal of the animal.

5.4 Investigators are responsible for the standard of animal care and use by all other persons involved in the project. They must ensure that the extent of supervision is compatible with the level of competence of each person and the responsibilities they are given.

5.5 Investigators should consult other experienced scientists, veterinarians, or laboratory animal, livestock or wildlife specialists when necessary.

5.6 Before any experimental activity involving the use of animals begins, investigators must submit a proposal to the AEC which demonstrates that the project will comply with the conditions of this Code and relevant legislation of the HKSAR Government.

5.7 Investigators must not begin an experimental activity involving the use of animals before written AEC approval is obtained, and must adhere to any requirements of the AEC.

5.8 Investigators must ensure that satisfactory arrangements are made for contacting them and other responsible persons in the event of emergencies.

5.9 Investigators must ensure that the choice of species is appropriate for the purpose of the project. Requirements for known genetic constitution, freedom from specific diseases, documented health, nutritional and environmental histories and other relevant factors should be taken into account. When the definition of the biological status of animals is necessary, investigators must ensure that the supplier can provide adequate proof of definition. Where relevant, species and individual animals should be chosen on the basis that the proposed projects will result in the least pain and distress. In making this decision, all aspects of the biological nature of the animals, including their behavioural characteristics and their cognitive development, should be taken into account.

5.10 Investigators must ensure that records of the use and monitoring of animals in experimental activities are maintained.

5.11 Investigators must inform the AEC when an approved project is completed or discontinued.

5.12 The investigator should promptly notify the AEC of any unexpected or adverse effects which occur during the period of the approved project and which impact on the welfare of the animals.

### **Planning projects**

5.13 In addition to the information required by the AEC, the investigator needs to address the following questions during the planning stages of a project:

- (i) Is the project justified ethically and scientifically?
- (ii) Can the aims be achieved without using animals?
- (iii) Has the most appropriate species of animal been selected?
- (iv) Are suitable holding facilities and competent staff available?

- (v) Have all staff been informed of the planned experimental and other procedures?
- (vi) Is the biological status (genetic, nutritional, microbiological, general health) of the animals appropriate?
- (vii) Are the environmental conditions (including caging or pen type, noise, photoperiod, temperature, humidity, ventilation, density of housing, and social structures) appropriate?
- (viii) Are the projects designed so that statistically valid results can be obtained using the minimum necessary number of animals?
- (ix) If the experimental activity could cause the animals any pain or distress, what will be done to minimize or avoid this?
- (x) What arrangements will be made to monitor the animals adequately?
- (xi) Have any of the projects been performed previously? If so, why should they be repeated?
- (xii) Are there any permits that must be obtained for the importation, capture, use, destruction or release of the animals?

## **Conduct of projects**

### **a. Limiting pain and distress**

5.14 Pain and distress cannot be evaluated easily in animals, and therefore investigators must assume that animals experience pain in a manner similar to humans. Decisions regarding their welfare in experimental activities must be based on this assumption unless there is evidence to the contrary.

5.15 The investigator must anticipate and take all possible steps to avoid or minimize pain and distress, including:

- (i) choosing the most humane method for the conduct of the project;

- (ii) ensuring the technical skills and competence of all persons involved in animal care and use;
- (iii) ensuring that animals are adequately monitored for evidence of pain and distress;
- (iv) acting promptly to alleviate pain or distress;
- (v) using anaesthetic, analgesic and tranquillizing agents appropriate to the species and the scientific aims;
- (vi) conducting projects over the shortest time practicable; and
- (vii) using appropriate methods of euthanasia.

5.16 The use of local or general anaesthetics, analgesics or tranquilizers must be appropriate to the species, and should at least parallel their use in current medical or veterinary practice.

5.17 Experimental activities which are liable to cause pain of a kind and degree for which anaesthesia would normally be used in medical or veterinary practice must be carried out under anaesthesia.

5.18 Distress can sometimes be avoided or minimized by non-pharmacological means. Before a project begins, animals should be appropriately conditioned to the project environment and procedures, and be familiar with handlers. During and after experimental procedures, appropriate nursing to minimize pain and distress, and to promote the well-being of the animals, must be provided.

5.19 The monitoring of animals must at all times be adequate to prevent the occurrence, or allow prompt alleviation, of pain or distress.

5.20 If animals develop signs of severe pain or distress despite the precautions outlined above, they must have the pain or distress alleviated promptly or must be euthanased and without delay. Alleviation of such pain or distress must take precedence over continuing or finishing the project.

**b. Signs of pain or distress**

5.21 Investigators should be familiar with the normal behaviour of the animal species chosen, be knowledgeable of signs of pain and distress specific to that species, and must monitor their animals for these signs.

5.22 Animals must be monitored to allow detection of deviations from normal behaviour patterns. Such deviations are often the first indications that animals are experiencing pain or distress. Assessments of change in patterns of sleeping, feeding, drinking, grooming, exploratory behaviour, performance in learning or discriminatory tasks, reproduction or social behaviour should be made.

5.23 Animals must be monitored appropriately for clinical signs of pain or distress. These may include one or more of the following: aggressive and/or abnormal behaviour (some species may become unduly submissive), abnormal stance or movements, abnormal sounds, altered cardiovascular and/or respiratory function, abnormal appetite, rapid decline in bodyweight, altered body temperature, vomiting and abnormal defecation or urination. Indicators of sustained pain or distress may include loss of body weight, failure to thrive, impaired reproductive ability and reduced resistance to disease.

**c. Repeated use of animals in experimental activities**

5.24 Individual animals must not be used in more than one project, without the express approval of the AEC. However appropriate re-use of animals may reduce the total number of animals used in a project, result in better experimental design, reduce distress or avoid pain to other animals.

5.25 When approving projects involving the re-use of animals, the AEC must be satisfied that either:

- (i) none of the procedures cause the animals pain or distress; or
- (ii) the second and subsequent projects produce little or no pain or biological stress to the animals (e.g. modifying diet, taking a succession of blood samples, repeated non-invasive recording procedures) and that the animals have recovered fully from the first project before further procedures are carried out.

**d. Duration of experimental activities**

5.26 Experimental activities, particularly those which involve any pain or distress, should be as brief as practicable. AEC approval must be sought for the continued long-term use of individual animals. The decision to continue must be based on the clinical well-being of the animal and the absence of aversion to the experimental situation.

**e. Handling and restraining animals**

5.27 Animals must be handled only by persons instructed and competent in methods which avoid distress and do not cause injury.

5.28 The use of restraint devices is sometimes necessary for the welfare of the animal and the safety of the handler. Restraint devices must be used to the minimum extent, for the minimum period required to accomplish the purpose of the project and be appropriate for the animal.

5.29 Tranquillizers or anaesthetics may aid restraint but may prolong recovery from the procedure. When these agents have been used, recovery of the animals must be monitored.

5.30 Periods of prolonged restraint should be avoided. Where animals are in prolonged restraint, consideration must be given to their biological needs, including their behavioural requirements, and they must be monitored regularly by a veterinarian or other qualified person not participating in the project. If any ill effects are shown, the animal must be removed from the restraint, or the method modified.

### **Completion of projects**

5.31 Upon completion of the project, animals must be returned promptly to either normal husbandry conditions or, if appropriate and permitted, to their natural habitat, or be euthanased.

5.32 Where practicable investigators should share with other investigators tissue from animals being killed.

### **Euthanasia of animals**

5.33 When it is necessary to kill an animal, humane procedures must be used. These procedures must avoid distress, be reliable, and produce rapid loss of consciousness without pain until death occurs. The procedures should also be compatible with the scientific aims.

5.34 The procedures must be performed only by persons competent in the methods to be used, or under the direct supervision of a competent person. The appropriate means must be readily at hand.

5.35 Animals should be killed in a quiet, clean environment, and normally away from other animals. There should be no disposal of the carcass until death is established.

5.36 Dependent neonates of animals being killed must also be killed or provision made for their care.

5.37 When fertilized eggs are used, the method of disposal must ensure the death of the embryo.

## **Autopsy**

5.38 Autopsy should be performed when animals die unexpectedly.

## **Additional considerations**

5.39 Anaesthesia and surgery must be performed by competent staff with appropriate training and experience. Instruction in surgical or anaesthetic techniques must be under the direct and constant supervision of such persons.

## **Surgery**

5.40 Surgical procedures must be carried out under appropriate local or general anaesthesia. There must be adequate monitoring for the depth of anaesthesia and of side effects such as hypothermia, and cardiovascular and respiratory depression.

5.41 The choice and administration of anaesthetic, analgesic and tranquillizing agents must be suitable for the species and appropriate for the purpose of the project.

5.42 When more than one surgical procedure is to be performed the animal must have recovered to good general health between each procedure. Every effort must be made to reduce the total number of procedures and the AEC must have been informed specifically of the need for more than one.

5.43 When the animal is not to recover from the surgery, it must be unconscious for the whole procedure, either by continuing the administration of the general anaesthetic or by inducing brain death.

5.44 When the animal is to recover from the anaesthetic, surgical procedures must conform to accepted standards in human and veterinary practice. Analgesics and tranquillisers must be used when required and their use should parallel that in current medical and veterinary practice.



## **Post-operative care**

5.45 The comfort of animals must be promoted throughout the post-operative period. Attention should be given to warmth, hygiene, fluid and food intake, and control of infection. The use of analgesics and tranquillizers may be needed to minimize post-operative pain or distress. Care should be taken that animals recovering from anaesthesia do not injure themselves by uncoordinated movements, and that conditions are such that they are not disturbed, attacked or killed by other animals in the same enclosure.

5.46 Appropriate clinical records must be kept, accessible to all involved in the postoperative care of the animal.

5.47 Investigators must ensure that adequate monitoring, treatment and care of postoperative animals are provided. They must ensure that they are fully informed of the animals' condition.

5.48 The duties of all staff must be clearly defined and ways of dealing with emergencies established.

5.49 Any post-operative animal observed to be in a state of severe pain or distress which cannot be alleviated quickly must be euthanased without delay.

5.50 Regular observation of surgical wounds is essential to check the progress of healing. Any problems must be attended to immediately.

## **Implanted devices**

5.51 Skilled and specialized attention is required in the care of animals following an operation in which monitoring or sampling devices have been implanted, or a fistula created. Regular observation is essential to determine signs of distress, pain or infection, which must be treated immediately.

## **Neuromuscular paralysis**

5.52 Neuromuscular blocking agents must not be used without adequate general anaesthesia or an appropriate surgical procedure which eliminates sensory awareness. Immobilization of an animal solely with a neuromuscular blocking agent is not acceptable. When these agents are used with an anaesthetic, special care must be taken to ensure the maintenance of an adequate plane of anaesthesia. Since criteria such as the character of respiration and corneal and flexor withdrawal reflexes cannot be used, continuous or frequent intermittent monitoring of physiological variables such as heart rate, blood pressure, pupil size and the electroencephalogram is necessary, together with the effects on these of mild sensory stimuli. Care is required to ensure that drugs used during procedures do not interfere with this monitoring.

## **SECTION 6 ACQUISITION AND KEEPING OF ANIMALS**

6.1 Animals should be obtained from breeding and supply facilities which maintain conditions consistent with this Code of Practice or relevant industry Codes.

### **Animals obtained from other countries**

6.2 There are a number of requirements governing the import, capture, handling and transport of animals. It is the responsibility of the investigators to consult the AEC and the relevant authorities of the HKSAR Government to ensure compliance with all requirements.

### **Transport of animals**

6.3 Transportation can cause distress due to confinement, movement, noise and changes in the environment and personnel.

6.4 The extent of any distress will depend on the animals' health, temperament, species, age, sex, the number traveling together and their social relationships, the period without food or water, the duration, the mode of transport, environmental conditions, particularly extremes of temperature, and the care given during the journey.

6.5 The conditions and duration of the transport must ensure that the health and well-being of the animals are not unduly compromised.

6.6 Potential sources of distress should be identified and steps taken to avoid or minimize their effects on the animals.

6.7 Containers must be escape and tamper-proof, there must be adequate nesting or bedding material and animals must be protected from sudden movements and extremes of climate.

6.8 Food and water must be provided when necessary.

6.9 Transport by air should be in accord with IATA regulations and domestic transport of livestock must be in accord with the relevant Codes of Practice.

6.10 Both the suppliers and recipients of animals must ensure that there are satisfactory delivery procedures, with animals received by a responsible person.

### **Admission of new animals into holding areas**

6.11 When new animals are being admitted into animal holding areas, they should be quarantined and inspected by a qualified person. Their health should be evaluated, treatment instigated if required, and their suitability for the proposed projects assessed. This period should allow their acclimatization to the holding facility and staff.

6.12 Animals which do not adapt satisfactorily to their new environment should not be kept and appropriate remedial action must be taken as soon as possible.

### **Care of animals in holding and production facilities**

6.13 Facilities include the buildings, yard or paddocks in which animals are kept.

6.14 Investigators, AECs and the institutions must ensure that facilities are appropriately staffed, designed, constructed, equipped and maintained to achieve a high standard of animal care and fulfill scientific requirements.

6.15 The design and management of facilities will depend on the type of animals to be kept and the projects to be undertaken. The overall condition and management of facilities must permit effective maintenance and servicing and be compatible with maintaining the animals in good health.

## **Outdoor holding areas**

6.16 These must be compatible with the needs of the species, provide adequate shelter and water, protect the animals from predation and meet other species specific needs.

## **Indoor housing**

6.17 Buildings should be compatible with the needs of the animals to be housed, and the projects undertaken. Facilities for free movement and group contact are specially important for some species of animals.

6.18 Buildings should be designed and operated to control environmental factors appropriately, to exclude vermin and to limit contamination associated with the keeping of animals, the delivery of food, water and bedding, and the entry of people and other animals.

6.19 Buildings must be maintained in good repair. Walls and floors should be constructed of durable materials that can be cleaned and disinfected readily.

6.20 Buildings must be kept clean and tidy, and operated to achieve the effective control of vermin.

6.21 There must be adequate storage areas for food and equipment.

6.22 Detergents, disinfectant, deodorants and pesticides may contaminate the animals' environment and choice of agents should be made in consultation with investigators.

6.23 There should be a reticulated water supply and proper facilities for drainage, if appropriate.

6.24 There must be adequate contingency plans to cover such emergencies as the breakdown of lighting, heating or cooling.

6.25 Precautions should be taken against the entry of unauthorized persons.

### **Environmental factors**

6.26 Animals must be provided with environmental conditions which suit their behavioural and biological needs unless otherwise approved by the AEC for the purposes of a project.

6.27 Air exchange, temperature, humidity, light and noise should be maintained within limits compatible with the health and well-being of the animals.

6.28 Effective ventilation is essential for the comfort of animals and the control of temperature, humidity, and odours. Ventilation systems should distribute air uniformly and achieve adequate air exchange.

6.29 Noxious odours, particularly ammonia, must be kept to a level compatible with the health and comfort of the animals and staff. The adequacy of the ventilation system, the design, construction and placement of cages and containers, population densities both within cages and within a room, the effectiveness of the cleaning and the frequency of bedding changes, will all influence the level of noxious gases. Attention should be given to the balance between the need for cleanliness and the potential impact of cleaning procedures on the animals.

6.30 These environmental factors potentially affect the welfare of the animals and may affect the results of experimental activities. Investigators should be informed in advance of planned changes to the environmental conditions of their animals.

## **Food and water**

6.31 Animals must receive appropriate, uncontaminated and nutritionally adequate food according to accepted requirements for the species. The food should be in sufficient quantity and of appropriate composition to maintain normal growth of immature animals or normal weight of adult animals and the requirements of pregnancy or lactation. Consideration should be given to providing variety in the composition and presentation of food. Uneaten perishable food should be removed promptly unless contrary to the needs of the species.

6.32 Drinking water should be constantly and reliably available, and be clean, fresh and uncontaminated.

6.33 Variations to these requirements as part of a project design must receive prior AEC approval.

## **Pens, cages and containers and the immediate environments of the animals**

6.34 Animal accommodation should be designed and managed to meet species specific needs. Pens, cages and containers should be constructed and maintained to ensure the comfort and well-being of the animals. The following factors should be taken into account:

- (i) species-specific behavioural requirements, including the availability and design of space to enable free movement and activity, sleeping, privacy, and contact with others of the same species;
- (ii) provision of single housing for animals when it is appropriate for the species and if necessary for the purpose of the project, e.g. during recovery from surgery or collection of samples;
- (iii) species-specific environmental requirements such as lighting, temperature, air quality, appropriate day/night cycles and protection from excessive noise and vibrations;
- (iv) the need to provide ready access to food and water;

- (v) the need to clean the pen, cage or container;
- (vi) protection from spread of pests and disease;
- (vii) requirements of the project; and
- (viii) the need to observe the animals readily.

6.35 Pens, cages and containers must:

- (i) be constructed of durable, impervious materials;
- (ii) be kept clean;
- (iii) be maintained in good repair;
- (iv) be escape-proof;
- (v) protect the animals from climatic extremes;
- (vi) not cause injury to the animals;
- (vii) be large enough to ensure the animals' well-being; and
- (viii) be compatible with the behavioural needs of the species.

6.36 The population density of animals within cages, pens or containers and the placement of these in rooms must be such that acceptable social and environmental conditions for the species can be maintained. Where it is necessary to individually house animals of a species which is normally kept in a social group, the conditions should be managed so as to minimize the impact of social isolation. Animals should be housed in these circumstances for the minimum time necessary.

6.37 Bedding and litter must be provided if appropriate to the species, and should be comfortable, absorbent, safe, non-toxic, able to be sterilized if needed and suitable for the particular scientific aims. Pregnant animals must be provided with nesting materials where appropriate.



6.38 The AEC and relevant investigators should be informed in advance of planned changes to these conditions, since these may affect the welfare of the animals and the results of the experimental activities.

### **Staff Management and Person-in-charge**

6.39 Animal acquisition, breeding and holding facilities must be supervised by persons with appropriate veterinary or animal care qualifications or experience.

6.40 The person-in-charge should be responsible for the management of the day-to-day care of the animals in holding and breeding facilities and for supervising the work of other staff in the facility, and should act as liaison between the investigator and facility staff.

6.41 The person-in-charge should ensure that there is reliable monitoring of the well-being of all animals by other staff, and be knowledgeable regarding signs of pain, distress and illness specific to each species housed. After animals are allocated to an approved project the investigator has primary responsibility for ensuring adequate monitoring of the animals' well-being.

6.42 The person-in-charge must ensure that ill or injured animals which are not assigned to approved projects are treated promptly and the cause of death investigated for animals which die unexpectedly.

6.43 The person-in-charge must ensure that staff are provided with appropriate protective clothing, maintain high standards of personal hygiene, do not eat, drink or smoke in animal areas, and have all required vaccinations, particularly against tetanus and other zoonoses.

## **Staff**

6.44 The most important factor ensuring high standards of animal care is enough well-trained, committed staff. Personnel working with animals in a holding facility should be appropriately instructed in the care and maintenance of those animals, how they may affect the animals' well-being and how their actions may affect the outcome of scientific activities.

6.45 Institutions should encourage and promote formal training in animal science or technology.

6.46 Personnel employed in the care of animals should be instructed in how to recognise at an early stage changes in animal behaviour, performance and appearance.

6.47 New appointees who will care for animals must be appropriately instructed in their duties and in institutional policy.

6.48 Staff should be informed of the important zoonotic diseases of animals under their care and of precautions that should be taken. Regular health checks of staff who handle animals are recommended in the interests of both staff and animals.

## **Disposal of animal carcasses and waste**

6.49 Appropriate provision must be made for prompt and sanitary disposal of animal carcasses and waste material in accord with guidelines and legislation of the HKSAR Government.

## **SECTION 7    CONSIDERATIONS FOR SPECIAL PROJECTS**

### **Animal models of disease**

7.1     The scientific validity of animal models of human diseases rests in part on how closely they resemble a particular disease. Thus the attendant pain and distress of the human diseases may also occur in the animal. Special care must be taken in selecting the appropriate species and the investigator must accept responsibility for ensuring that any pain or distress is minimized and that the AEC is informed of the potential effects of the disease on the animals. The use of painful, distressful or lingering death as an end-point is considered to be illegal and ethically unacceptable and must be avoided. When death as an endpoint is unavoidable in projects, and no other experimental endpoint is feasible, then the experiment must therefore be designed to prevent suffering and result in the deaths of as few animals as possible.

### **Modifying animal behaviour**

7.2     Procedures used to modify an animal's behaviour or to induce it to perform specific tasks depend on motivating the animal. The preferred inducement is positive reinforcement, but the inducement may be some form of biological stress. This stress should be as mild as possible. Severe water, food, social or sensory deprivation must not be used. Painful or noxious stimuli must be limited to those which do not distress human beings, and must be used for the minimum time necessary. Behaviour can usually be modified using procedures that involve no more than a physiological stress, e.g. thirst within the range of the normal experience of the species.

## **Toxicological projects**

7.3 Investigation of the safety of agents intended for use in human beings, animals, the household or the environment, or of naturally occurring toxins, should be performed by persons with appropriate training. If suitable non-animal tests are available, they must be used. In particular, *in vitro* methods should be used as an initial screening test wherever possible.

7.4 The end-point of such projects must be as early as is compatible with reliable assessment of toxicity, and must prevent any pain and distress.

7.5 Investigators must not allow experimental activities to proceed to the painful or distressful or lingering death of animals. When death as an endpoint is unavoidable in projects, and no other experimental endpoint is feasible, then the experiment must therefore be designed to prevent suffering and result in the deaths of as few animals as possible.

7.6 When death is essential as the end-point, the project must be designed to result in the deaths of as few animals as possible, and to prevent animal suffering.

## **Experimental activities involving hazards to humans or other animals**

7.7 Hazards may arise from sources including viruses, bacteria, fungi, parasites, radiation, radioactivity, corrosive substances, toxins, allergens, carcinogens, recombinant DNA, anaesthetic gases and physical injuries.

7.8 Any potential pathogenic effects of these hazards when used in projects must be explained as far as possible to all staff. Tests before, during and after the project may be required for staff.

7.9 The AEC should ensure that appropriate measures for containment, disposal and decontamination have been established.

7.10 Animals being administered infectious organisms should be housed in appropriate quarantine facilities, taking into account risks to other animals and to people.

7.11 The end-point of projects involving hazardous agents should conform to the requirements for toxicological projects.

7.12 Precautions, security and emergency plans to contain hazardous agents must be appropriate to a 'worst-case' situation.

### **Animal welfare and animal health research**

7.13 When projecting ways of improving the health or welfare of animals, investigators may need to design projects that replicate the problem such as injury, trauma, nutritional disorder, physical exertion, disease or environmental stress. Thus, the attendant pain or distress may also be replicated. When such projects are necessary, the investigator must ensure that:

- (i) the principal aim of the project is to improve animal welfare or health;
- (ii) alternative methods are not possible, such as the use of animals already subjected to the problem;
- (iii) all possible steps are taken to minimize any pain or distress; and
- (iv) the end-points of projects conform to the requirements for toxicological projects.

### **Experimental manipulation of animals' genetic material**

7.14 All proposals to manipulate the genetic material of animals, their germ cells or embryos or all proposals involving the introduction of foreign DNA into mammalian cells or whole animals must also be submitted to an AEC for approval, and the AEC should ensure that appropriate containment, disposals and decontamination have been established.

7.15 The manipulation of the genetic material of animals has the potential to affect the welfare of the animals or their offspring adversely. Investigators must inform the AEC of the known potential adverse effects on the well-being of the animals, or potential biohazard caused by manipulation of the genetic material of animals.

7.16 The clinical status of animals in which the genetic material has been manipulated experimentally must be monitored for unusual or unexpected adverse effects. Investigators must report such effects to the AEC.

### **Experimental induction of neoplasia**

7.17 The site for induction or transplantation of tumours (neoplasia) must be chosen carefully. Subcutaneous, intradermal and flank sites should be chosen when possible. Footpad, brain and eye sites must not be chosen unless there is no alternative.

7.18 Investigators must monitor their animals closely for signs of pain or distress, especially sudden changes in body weight.

7.19 Animals with experimentally induced or transplanted tumors must be euthanased before predictable death occurs, cachexia becomes advanced, or the tumor becomes large enough to cause ulceration or severe limiting of normal behaviour.

7.20 With ascitic tumors, including hybridomas, investigators must ensure that the volume of ascitic fluid does not cause gross abdominal distension, and the volumes of solid tumors and cachexia do not become distressful to the animals.

7.21 In tumor therapy projects, the end-points chosen must be as early as possible, compatible with reliable assessment of the therapy. Weight changes must be monitored closely. Death from the tumor must not be chosen as an experimental end-point.

## **Lesions of the central nervous system**

7.22 Anatomical or chemical lesions of the central nervous system have been widely used to project its structure and function in health and disease. These projects demand special consideration when the lesion produces loss or impairment of limb or trunk movements, loss of sensibility to touch, temperature or pain, impairment of the animal's awareness of its surroundings or impairment of appetite or thirst mechanisms. Special animal care, caging, and other facilities may be needed, and the AEC, in approving such projects, has a particular responsibility to ensure that these facilities are available and that the condition of the animals is closely monitored.

## **Withholding food or water**

7.23 Projects involving the withholding or severe restriction of food or water should produce no continuing detrimental effect on the animal. In these projects, the fluid balance and/or body weight must be monitored, recorded and maintained within the limits approved by the AEC.

## **Fetal experimentation**

7.24 When fetal experimentation or surgery compromises the ability of the neonate to survive and be without pain or distress, it must be euthanased before or immediately following birth unless such pain or distress can be relieved.

7.25 Unless there is specific evidence to the contrary, investigators must assume fetuses have the same requirements for anaesthesia and analgesia as adult animals of the species.

7.26 During surgery of the mother, consideration must be given to any special requirements for anaesthesia of the fetus.

7.27 Eggs must be destroyed before hatching, unless hatching is a requirement of the project. The AEC must approve the arrangements made for the hatchings.

## **Research on pain mechanisms and the relief of pain**

7.28 In projects in which unanaesthetised animals are to be subjected to stimuli designed to produce pain, investigators must:

- (i) ensure that these stimuli limit pain at all times to levels comparable to those which do not distress human beings;
- (ii) ensure that the animals are exposed to the minimum pain necessary for the purpose of the procedure; and
- (iii) provide treatment for the relief of pain, or allow self-administration of analgesics, or escape from repetitive, painful stimuli, when possible.

## **Projects using wildlife**

7.29 The principles set out in this Code apply equally to wild and feral animals, with AEC being required to be aware of the unique animal welfare concerns relevant to the particular species.

## **Projects using livestock**

7.30 The principles set out in this Code apply equally to livestock animals, with AEC being required to be aware of the unique animal welfare concerns relevant to the particular species.

## **Acknowledgement**

National Health and Medical Research Council of Australia



## Appendix A

### **Legislative control of the use of animals for experimental purposes**

All experiments must fulfill all relevant legislation and Codes of Practice in Hong Kong, including, but not limited to:

- Animals (Control of Experiments) Ordinance, Cap. 340,
- Prevention of Cruelty to Animals Ordinance, Cap. 169,
- Dangerous Drugs Ordinance, Cap. 134,
- Antibiotics Ordinance, Cap. 137,
- Pharmacy and Poisons Ordinance, Cap. 138,
- Public Health (Animals and Birds) Ordinance, Cap. 139,
- Animals and Plants (Protection of Endangered Species) Ordinance, Cap. 187,
- Radiation Ordinance, Cap. 303,
- Occupational Safety and Health Ordinance, Cap. 509, and
- Code of Practice for the Welfare of Food Animals, Food and Environmental Hygiene Department

For more information, please refer to <http://www.legislation.gov.hk>

## **Appendix B**

### **Bibliography**

#### **Animal Welfare Legislation and Code of Practices**

##### **Publications:**

Dolan, K, 2000, *Laboratory Animal Law*, Blackwell Science, London, UK

National Health and Medical Research Council, 2004. *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes* (7<sup>th</sup> edn.), Australia.

National Advisory Committee for Laboratory Animal Research, *Guidelines for Institutional Animal Care and Use Committee*, Singapore.

National Advisory Committee for Laboratory Animal Research, *The Guiding Principles for the Care and Use of Animals for Scientific Purposes*, Singapore.

Weinberg, S (eds.) 1995, *Good Laboratory Practice Regulations* (2<sup>nd</sup> ed.), Marcel Dekker, New York, USA.

##### **Websites:**

Animal Welfare Act and Regulations  
<http://www.nal.usda.gov/awic/legislat/usdaleg1.htm>

Additional Federal Animal Care Legislation, Policies, GLP's, etc.  
<http://www.nal.usda.gov/awic/legislat/usdaleg2.htm>

Hong Kong Code of Practice and List of Animal Welfare Groups  
Willing to Participate on AECs:

<http://www.afcd.gov.hk/quarantine/am/dog/code.htm>

Hong Kong Department of Justice: Bilingual Laws Information  
System

<http://www.legislation.gov.hk>

Office of Animal Care and Use – Regulations and Standards

<http://oacu.od.nih.gov/regs/>

### **Handling, Techniques and Husbandry**

#### **Publications:**

Allen, AM & Nomura, T (eds.) 1986, *Manual of Microbiological Monitoring of Laboratory Animals*. National Institutes of Health, Bethesda MD USA.

Anderson, RS & Edney, ATB (eds.) 1991, *Practical Animal Handling*. Pergamon Press, Oxford London.

Baker, DG 2003, *Natural Pathogens of Laboratory Animals: Their effects on Research*. ASM Press, Washington DC.

Calabrese, EJ 1991. *Principles of Animal Extrapolation*. Lewis Publishers, Michigan, USA.

Canadian Council on Animal Care *Guide to the Care and Use of Experimental Animals*. Vol. 1, 1993, 2<sup>nd</sup> edn.; Vol. 2, 1984, CCAC, Ottawa Canada.

Festing MFW, Overend P, As Rg, Borja, MC & Berdoy, M 2002, *The Design of Animal Experiments. Laboratory Animals Handbook No 14*. Royal Society of Medicine Press, London.

Flecknell, PA 1996, *Laboratory Animal Anaesthesia – A Practical Introduction for Research Workers and Technicians*, 2<sup>nd</sup> edn., Academic Press, London UK.

Flecknell, PA & Waterman-Pearson, A (eds.) 2000, *Pain Management in Animals*, WB Saunders, London.

Fox JG, Anderson LC, Loew, FM & Quimby, FW (eds.) 2002, *Laboratory Animal Medicine*. 2<sup>nd</sup> edn. American College of Laboratory Animal Medicine series. Academic Press, Orlando Florida USA.

Gay, WI (ed.) 1965-86, *Methods of Animal Experimentation*, Vols.1-7. Academic Press, New York USA.

Loeb, WF & Quimby, FW 1989, *The Clinical Chemistry of Laboratory Animals*. Pergamon Press, New York USA.

Lumley JSP, Green CJ, Lear, P & Angell-James, JE 1990, *Essentials of Experimental Surgery*. Butterworth & Co., London.

Mitruka, BM & Rawnsley, HM 1981, *Clinical Biochemical and Hematological Reference Values in Normal Experimental Animals and Normal Humans*, 2<sup>nd</sup> edn, Masson, New York USA.

Morris TR 1999, *Experimental Design and Analysis in Animal Sciences*. CABI Publishing, London, UK.

Nagy A, Gertsenstein M, Vintersten, K & Behringer, R 2003, *Manipulating the Mouse Embryo*, Cold Spring Harbor Laboratory Press, New York.

National Research Council 1996. *Guide for the Care and Use of Laboratory Animals*. National Research Council. National Academy Press, Washington USA.

Ostrander, G 2000, *The Laboratory Fish, Handbook of Experimental Animal Series*, Academic Press, San Diego, USA.

Owen, DG 1992, *Parasites of Laboratory Animals*, Royal Society of Medicine Press, London.

Pinkert, CA (ed.) 1994, *Transgenic Animal Technology, A Laboratory Handbook*, Academic Press, San Diego, USA.

Poole, TB (ed.) 1999, *UFAW Handbook on the Care and Management of Laboratory Animals*, 7<sup>th</sup> edn, Vols 1 & 2, Universities Federation for Animal Welfare. Blackwells Scientific and Technical, Harlow UK.

Tumbelson, ME & Schook, LB 1996, *Advances in Swine in Biomedical Research*, Vols 1& 2, Plenum Press, New York, USA.

Van Zutphen LFM, Baumans, V & Beynen, AC (eds.) 1993, *Principles of Laboratory Animal Science – A Contribution to the Humane Use and Care of Animals and to the Quality of Experimental Results*. Elsevier Science Publishers B.V., Amsterdam, The Netherlands.

Ward, J. 2000, *Pathology of Genetically-engineered Mice*, Iowa State University Press, Iowa.

Waynforth, HB & Flecknell, PA 1992, *Experimental and Surgical Technique in the Rat* (2<sup>nd</sup> edn), Academic Press, London, UK.

### **Websites:**

Canadian Council on Animal Care  
<http://www.ccac.ca/english/new/newframe.htm>

Laboratory Animal Training Association  
<http://www.latanet.com/>

Office of Animal Care and Use  
<http://oacu.od.nih.gov/index.htm>

Office of the Gene Technology Regulator

<http://www.ogtr.gov.au/>

The Royal Society 2001, *The use of genetically modified animals*

[www.royalsoc.ac.uk/policy/index.html](http://www.royalsoc.ac.uk/policy/index.html)

Training in Survival Rodent Surgery

[http://oacu.od.nih.gov/ppt\\_slides/](http://oacu.od.nih.gov/ppt_slides/)

### **Welfare, Ethics and Other Resource Materials for Animal Experimentation Ethics Committee**

#### **Publications:**

Appleby, MC & Hughes, BO 1997, *Animal Welfare*. CAB International Oxford.

Armstrong, SJ & Botzler, RG (eds.) 2003, *The Animal Ethics Reader*, Routledge, London.

AVMA Colloquium 1987, *Recognition and alleviation of animal pain and distress*. Journal of the American Veterinary Medical Association, 191(10):pp 1184-1298.

Broom, DM & Johnson, KG 1993, *Stress and Animal Welfare*. Chapman and Hall Animal Behaviour Series. Chapman and Hall, London UK.

Dolan, K, 1999, *Ethics, Animals and Science*. Blackwell Science, London, UK.

Donnelley, S & Nolan, K (eds.) 1990, *Animals, Science and Ethics*. Special Supplement. Hastings Center Report, 20(3), May/June 1990.

Hellebrekers, LJ (ed.) 2000, *Animal Pain*, van der Wees, Utrecht, The Netherlands.

Hendriksen, CFM & Morton, DB (eds.) 1999, *Humane End-points in Animal Experiments for Biomedical Research*. Royal Society of Medicine, London.

Kohn DF, Wixson S, White, WJ & Benson, GJ (eds.) 1996, *Anaesthesia and Analgesia in Laboratory Animals*. Academic Press, USA

Moberg, GP (ed.) 1985 *Animal Stress*, American Physiological Society, Williams & Wilkins, Baltimore, USA.

Moberg, GP & Mench, JA (eds.) 2000, *The Biology of Animal Stress. Basic Principles and Implications for Animal Welfare*. CAB International, New York.

National Research Council 1992. *Recognition and Alleviation of Pain and Distress in Laboratory Animals. Committee on Pain and Distress in Laboratory Animals*, National Research Council. National Academy Press, Washington USA.

Orlans, FB 1993, *In the Name of Science. Issues in Responsible Animal Experimentation*. Oxford University Press, New York USA.

Paton, W 1993, *Man and Mouse: Animals in Medical Research*, 2<sup>nd</sup> edn, Oxford University Press, New York USA

Podolsky, ML & Lukas, VS (ed.) 1999, *The Care and Feeding of an Institutional Animal Care and Use Committee*, CRC Press, Florida, USA.

Rudacille, D 2001, *The Scalpel and the Butterfly: The conflict between animal research and animal protection*. University of California Press, Berkeley.

Russell, WMS & Burch, RL 1992, *The Principles of Humane Experimental Technique*, 2<sup>nd</sup> edn, Methuen, London UK.

Short, CE & Poznak, AV (eds.) 1992, *Animal Pain*. Churchill Livingstone, New York.

Smith, J & Boyd, KM (eds.) 1991, *Lives in the Balance. The Ethics of Using Animals in Biomedical Research*. Oxford University Press, Oxford UK.

Van Zutphen, LFM & Bedford, PGC. (eds.) 1999, *Genetics and Animal Welfare*. Animal Welfare. Animal Welfare Vol. 8 No 4 (Special Issue).

Van Zutphen, LFM & van der Meer, M (eds). 1995, *Welfare Aspects of Transgenic Animals*, Proceedings EC-Workshop, Springer-Verlag, Berlin.

Van Zutphen, LFM & Balls, M (eds.) 1997, *Developments in Animal and Veterinary Sciences, 27, Animal Alternatives, Welfare and Ethics*, Elsevier, Amsterdam.

Young, RJ 2003, *Environmental Enrichment for Captive Animals*. UFAW Animal Welfare Series, Blackwell Publishing, UK.

### **Websites:**

The American Veterinary Medical Association  
<http://www.avma.org/>

2000 Report of the AVMA Panel on Euthanasia  
<http://www.avma.org/resources/euthanasia.pdf>

Australian and New Zealand Council for the Care of Animals in Research and Teaching  
<http://www.adelaide.edu.au/ANZCCART/index.html>



The Boyd Group 1999, *Genetic Engineering: animal welfare and ethics* [www.boydgroup.demon.co.uk/genmod.htm](http://www.boydgroup.demon.co.uk/genmod.htm)

Charles River Laboratories  
<http://www.criver.com/>

Fund for the Replacement of Animals in Medical Experiments (FRAME):  
[www.frame.org.uk](http://www.frame.org.uk)

Home Office  
<http://www.homeoffice.gov.uk/default.asp>

The Animal Procedures Committee  
<http://www.apc.gov.uk/>

Animals in Scientific Procedures  
<http://www.homeoffice.gov.uk/comrace/animals/index.html>

Humane Society International Australian Office  
<http://www.hsi.org.au/>

The Humane Society of the United States  
<http://www.hsus.org/ace/352>

Information Resources for Institutional Animal Care and Use Committees 1985-1999  
<http://www.nal.usda.gov/awic/pubs/IACUC/>

Pain Management and Humane Endpoints  
<http://www.nal.usda.gov/awic/pubs/IACUC/pain.htm>

Primary References Material for the Institutional Animal Care and Use Committee  
<http://www.nal.usda.gov/awic/pubs/IACUC/primary.htm>

Institute for Laboratory Animal Research  
<http://dels.nas.edu/ilar/index.asp?id=index>

Institutional Animal Care and Use Committees

<http://www.iacuc.org/>

International Council for Laboratory Animal Science

<http://www.iclas.org/index.htm>

The Jackson Laboratory

<http://www.jax.org/>

Ministry of Agriculture and Forestry - New Zealand - Animal Welfare

<http://www.maf.govt.nz/biosecurity/animal-welfare/>

National Center for Research Resources (NCRR)

<http://www.ncrr.nih.gov/>

National Health and Medical Research Council - Animal Ethical Issues

<http://www7.health.gov.au/nhmrc/issues/animalethics.htm>

NORINA (A Norwegian Inventory of Audiovisuals)

<http://www.bio.mq.edu.au/norina/>

Office of Laboratory Animal Welfare

<http://grants.nih.gov/grants/olaw/olaw.htm>

Royal Societies for the Prevention of Cruelty to Animals in Australia

<http://www.rspca.org.au/>

Universities Federation for Animal Welfare

<http://www.ufaw.org.uk/>

Velkommen til Vivarium

<http://www.uib.no/vivariet/>

## **Occupational Health and Safety**

### **Publications:**

Kennedy, ME 1996, *Laboratory Biosafety Guidelines*. 2<sup>nd</sup> edn. Laboratory Centre for Disease Control, Health Canada, Ottawa, Ontario, Canada.

National Research Council 1997. *Occupational Health and Safety in the Care and Use of Research Animals*. National Research Council. National Academy Press, Washington USA

Wood, M & Smith, MW 1999, *Health and Safety in Laboratory Animal Facilities*, Laboratory Animal Handbooks, No. 13, Royal Society of Medicine, London.

### **Websites:**

Public Health Agency of Canada - Material Safety Data Sheets (MSDS)

<http://www.hc-sc.gc.ca/pphb-dgspsp/msds-ftss/index.html#menu>

Science Education Section of Education Manpower Bureau of the Hong Kong SAR Government; [www.emb.gov.hk/cd/sc](http://www.emb.gov.hk/cd/sc))  
Safety in Science Laboratories (The Education Department already has a guideline on the use of animals for teaching purposes)

[http://cd1.emb.hkedcity.net/cd/science/laboratory/safety/SHB\\_2002e.pdf](http://cd1.emb.hkedcity.net/cd/science/laboratory/safety/SHB_2002e.pdf)

[http://cd1.emb.hkedcity.net/cd/science/laboratory/safety/SHB\\_2002c.pdf](http://cd1.emb.hkedcity.net/cd/science/laboratory/safety/SHB_2002c.pdf)