Canadian Council on Animal Care

guidelines on:

procurement of animals used in science

This document, the *CCAC guidelines on: procurement of animals used in science*, has been developed by the ad hoc subcommittee on procurement of the Canadian Council on Animal Care (CCAC) Guidelines Committee.

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In addition, the CCAC is grateful to Dr. Denna Benn, University of Guelph, and Mr. Robert Van Tongerloo, formerly with the Canadian Federation of Humane Societies, who provided considerable assistance in the preliminary phases of this project. The CCAC also thanks the many individuals, organizations and associations that provided comments on earlier drafts of this guidelines document.

ISBN: 0–919087–46–9

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This document has been developed by the CCAC subcommittee on procurement of animals used in science. The guidelines outlined within the document seek to establish best practice for the procurement of animals to be used in Canadian science. For the CCAC, best practice incorporates the principle of guidelines that are based on sound scientific evidence and expert opinion, subject to peer review. The establishment of best practice also includes the adherence to ethical principles generally accepted by the Canadian public. For the CCAC, these ethical principles are described within the *CCAC policy statement on: ethics of animal investigation* (1989), and are based on the Three Rs: Reduction, Refinement and Replacement, as outlined by Russell & Burch (1959).

For the purposes of this guidelines document, *procurement* is inclusive of an assessment of the standards of animal care used by the supplier of the animals, the quality of the animals, the transportation of the animals and their handling during transportation, and any required conditioning of the animals upon arrival at the user institution.

This guidelines document provides general recommendations that are intended to give animal care committees (ACCs) and investigators an overview of the issues that need to be considered in the procurement of animals. However, each species will have a unique set of requirement in terms of transportation, quarantine, acclimation and conditioning, and it is recommended that other relevant CCAC guidelines be consulted, as well as relevant experts and literature for the species under consideration.

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2 INTRODUCTION

2.1 Ethical Considerations

Guideline 1:

The use of animals in science is acceptable only if it contributes to the understanding of fundamental biological or behavioural principles, or to knowledge that can be expected to benefit humans or animals.

The underlying ethical basis of CCAC guidelines and policies requires adherence to the Three Rs principles of humane experimental technique outlined by Russell and Burch: Replacement, Refinement and Reduction (Russell & Burch, 1959). Animals may only be used if there is no alternative experimental approach to obtain the required information. Investigators should explore alternative models to animal use, and should detail the efforts that have been made to find replacement alternatives in their animal use protocols (see *CCAC policy statement on: terms of reference for animal care committees*, Section 3c; CCAC, 2006). The use of animals for biomedical science must be based on the appropriateness of the model for the scientific goal of the study, and not on other factors such as economics or the availability of animals within the institution. The fewest animals appropriate to provide valid information and statistical significance should be used (CCAC, 1997), and the numbers of animals maintained should not exceed the number that an institution can successfully house and care for, as outlined in CCAC guidelines. Support for Canadian research to meet the highest international scientific standards of excellence and ethics is underlined by The Canadian Institutes for Health Research Act (http://laws.justice.gc.ca/en/c-18.1/30865.html).

2.2 Responsibilities

2.2.1 Responsibilities of Investigators

Guideline 2:

Investigators must use the smallest number of animals necessary to obtain valid information.

Guideline 3:

Prior to arranging for procurement of animals, investigators should ensure that the facilities and expertise are available to care for the animals.

Early in any animal-based project or the grant application and peer review process, the investigator should discuss the proposed research with the animal care committee (ACC) and the animal care services, to ensure that appropriate facilities are available (e.g., appropriate housing, equipment and space). If the animal species or model has not been used within the institution previously, the institution and its ACC and animal care services should also ensure that animal care personnel and any research assistants have the appropriate training and/or experience and equipment to be able to provide for the needs of the animals.

2.2.2 Responsibilities of Institutions

Guideline 4:

Where possible, institutions should strive to ensure the animals have a defined health status.

Institutions are encouraged to establish a good working relationship with animal suppliers. Where possible, site visits to the suppliers should be carried out, in order to provide quality assurance of their processes and practices.

Reputable suppliers should be able to provide information on the health status of the animals. It is in the best interest of the users (principal investigator and animal care services) and the supplier to cooperate in the elimination of any undesirable condition affecting the health and quality of the animals. This is paramount to the maintenance of the integrity of the animal facility itself and to achieving the scientific objectives. The institution should inform the supplier of any undesirable conditions observed in the animals received.

2.2.3 Responsibilities of Veterinarians

Guideline 5:

The institutional veterinarian should have ultimate responsibility for ensuring procurement of healthy animals.

Veterinarians play a critical role in the procurement of animals. Their responsibilities include, but are not limited to:

- identifying potential sources and suppliers of animals;
- developing or assisting in developing in-house quarantine and conditioning programs and other relevant Standard Operating Procedures (SOPs), e.g., health and safety policies;
- educating members of the ACC and researchers/animal users on the pros and cons of utilizing various sources, including public perception and related concerns;
- providing assistance to researchers in selection of animal models; and
- overseeing routine inspection of animal suppliers (including record keeping) when warranted (e.g., pound source dogs, private breeding colonies, etc.), and developing a good working relationship with suppliers to negotiate appropriate holding times, delivery and transportation methods, and animal selection routines.

Where there is no institutional veterinarian onsite, the consulting or attending veterinarian should be responsible for ensuring that the above duties are performed. The *CALAM/ACMAL Standards of Veterinary Care* (CALAM/ACMAL, 2004) provides additional detailed guidance on the responsibilities of veterinarians working with animals used in science.

2.2.4 Responsibilities of Animal Care Committees

Guideline 6:

The acquisition of animals must be dependent upon the prior approval of the project by the animal care committee.

Each institution should have an up-to-date and ongoing inventory of all animal experiments for which they are accountable, and procedures for preparation of appropriate space and such other arrangements as may be necessary prior to the reception of incoming animals.

At times, it may be necessary to acquire animals on a seasonal basis in anticipation of future use, for example in the case of farm animals. However, this should only be done in exceptional circumstances, and the animals should be sold, transferred or otherwise disposed if there is no subsequent need for them.

In-house breeding of animals should be approved based on the approved requirements of the investigators. Other options should be explored, such as embryo cryopreservation of lines not currently needed and purchasing animals as needed from commercial suppliers.

For wildlife studies involving the short-term holding of wild animals, protocols should be reviewed in line with the *CCAC guidelines on: the care and use of wildlife* (2003). If animals are to be brought into the facility, SOPs for biosecurity and housing must be approved beforehand.

2.3 Regulations

Guideline 7:

Acquisition of animals must follow federal and provincial/territorial regulations, and facilities must comply with all applicable regulations for identification of animals.

As well as the general regulations identified below, the regulations sections of relevant CCAC guidelines should also be consulted (e.g., *CCAC guidelines on: the care and use of wildlife* (2003), *the care and use of fish in research, teaching and testing* (2005) and *the care and use of farm animals in research, teaching and testing* (in prep.). *The Canadian Association for Laboratory Animal Medicine Standards of Veterinary Care* (2004) indicates the responsibilities of laboratory animal veterinarians in sourcing and procuring animals, and this document is used by the CCAC as a reference for assessment of animal care and use programs.

Any animals received as donations for research should have been released for research in accordance with the applicable regulations.

2.3.1 Federal

The Criminal Code of Canada

Sections 446 and 447 of the *Criminal Code* protect animals from cruelty, abuse and neglect (http://laws.justice.gc.ca/en/C-46/index.html).

The Health of Animals Act

The *Health of Animals Act* and its regulations (http://laws.justice.gc.ca/en/h-3.3/index.html) are aimed primarily at protecting Canadian livestock from a variety of infectious diseases that would threaten both the health of the animals and people, and Canadian trade in livestock with other countries. This Act and its regulations are used both to deal with named disease outbreaks in Canada, and to prevent the entry of unacceptable diseases that do not exist in Canada.

Under this Act, the Canadian Food Inspection Agency (CFIA) (www.inspection.gc.ca) is responsible for administering and enforcing the *Health of Animals Regulations*, which covers the humane transportation of animals in Canada, and details requirements for such elements as the provision of food, water and rest, protection from adverse weather, use of proper containers and transport vehicles, and segregation of incompatible animals. This Act and its regulations also specify that livestock, poultry, animal embryos and animal semen exported from Canada must be accompanied by a health certificate issued or endorsed by a CFIA veterinary inspector, and that CFIA is responsible for testing, inspection, permit issuing and quarantine activities for live animals imported to Canada.

Fish and Wildlife Regulations

Permits may be required for the acquisition and transport of fish. Advice should be sought from Fisheries and Oceans Canada (DFO) and the responsible provincial government department(s). Marine mammals are also covered by the *Fisheries Act* and regulations (http://lois.justice.gc.ca/en/F-14) administered by DFO (see *CCAC guidelines on: the care and use of fish in research, teaching and testing* (2005) for the relevant Acts and regulations).

The Canadian Wildlife Service (www.cws-scf.ec.gc.ca) promotes the conservation of Canadian and international wildlife and biological diversity by managing migratory birds and nationally significant habitat, and by providing leadership on other issues such as recovery of endangered species (see *CCAC guidelines on: the care and use of wildlife* (2003) for the relevant Acts and regulations).

The Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act (WAPPRIITA) is the enabling legislation for the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) in Canada (see Section 3.4.1). WAPPRIITA also provides the authority to protect Canadian ecosystems from the introduction of listed harmful invasive species by requiring permits and making it an offence to transport an animal or plant from one province or territory to another, or export from a province or territory, without the required provincial or territorial permits.

New Substances Notification Regulations, Canadian Environmental Protection Act

The responsibility for regulating genetically-engineered livestock animals is shared between Environment Canada (EC) and Health Canada (HC), with support from the Canadian Food Inspection Agency (CFIA). EC and HC are both responsible for environmental and indirect human health safety assessments, while HC also assesses food safety of products and by-products obtained from genetically-engineered animals. CFIA is responsible for feed safety assessments, and also for risk assessment from an animal health perspective. This approach is based on principles that are an integral part of the foresight processes that formed the basis for a federal regulatory framework (CFIA, 2004; http://www.inspection.gc.ca/english/anima/biotech/guidedirecte.shtml).

All new substances, including certain living organisms, are governed by the *Canadian Environmental Protection Act* (CEPA), 1999 (http://lois.justice.gc.ca/en/C-15.31). This Act is co-administered by EC and HC. The term biotechnology is defined in CEPA as "the application of science and engineering to the direct or indirect use of living organisms or parts or products of living organisms in their natural or mod-

ified forms". This legal definition casts a very wide net. By extension of the definition, all livestock manipulated through science and engineering are considered to be biotechnology-derived animals, including transgenic animals and SCNT derived clones of animals. The classification of a product as new is determined by whether or not the substance appears on the domestic substances list (DSL).

Any institution or individual who plans to manufacture or import an animal subject to notification under the New Substances Notification Regulations (Organisms) must provide Environment Canada with a New Substances Notification package containing all information prescribed in the Regulations at least 120 days prior to manufacture or import. The information provided will then be assessed by the New Substances program of Environment Canada and Health Canada to determine whether the new animal represents a risk to the environment, biodiversity or human health. More information on the requirements under the New Substances Notification Regulations (Organisms) is available at www.ec.gc.ca/substances/nsb/eng/home_e.shtml.

2.3.2 Provincial/Territorial

While all of the provinces have legislation concerning animal welfare, only certain provinces have legislation which specifically addresses animals acquired and used for scientific purposes (see below).

All provinces and territories in Canada have legislation governing the use of wildlife, and the appropriate provincial or territorial agency should be consulted when planning a project involving wildlife. Licenses or permits are required for the killing, capture, holding, marking, transport, trade, and sometimes release of most wildlife. This includes wildlife held for research, teaching, and interpretive purposes.

All provinces maintain legislation covering the conduct of veterinarians and as such, license these veterinarians in the execution of their duties (e.g., prescription drug use and records, treatment of animal disease, humane euthanasia, etc.).

Alberta

Alberta's *Animal Protection Act* and the *Animal Protection Regulations* control the use of animals for research activities. The regulations specifically state that a person who owns or has custody, care or control of an animal for research activities must comply with the listed Canadian Council on Animal Care guidelines and policies (http://www.qp.gov.ab.ca/catalogue/catalog_results.cfm?frm_isbn=0779741455&search_by=link).

Prince Edward Island

In Prince Edward Island, the *Animal Protection Regulations* made under the *Animal Health and Protection Act* state that the conditions governing the care of animals used for medical or scientific research shall be those contained in volumes 1 and 2 of the *Guide to the Care and Use of Experimental Animals* published by the CCAC (http://www.canlii.org/pe/laws/regu/1990r.71/20060412/whole.html).

Manitoba

Under the *Animal Care Act of Manitoba*, no one may cause suffering to an animal; however, the Act also lists certain "accepted activities" that are exempt from this as long as these activities are carried out in accordance with a standard or code of conduct, criteria, practice or procedure specified as acceptable in the regulations. The use of animals for research and teaching is an accepted activity, and according to the *Animal Care Regulations*, section 4(4): "Animals raised for the purpose of, or used in research and teaching activities, shall be kept in accordance with the *Guide to the Care and Use of Experimental Animals* [Volumes 1 and 2] and in policies and guidelines, published by the Canadian Council on Animal Care, as revised from time to time" (http://web2.gov.mb.ca/laws/statutes/ccsm/a084e.php). As a result of this obligation, the CCAC's system of oversight covers the breeders of experimental animals operating in Manitoba.

New Brunswick

In New Brunswick, the law only indirectly governs the use of animals for experimental and other scientific purposes. Section 18(1) of the *Society for the Prevention of Cruelty to Animals Act* provides that "[a] person who has ownership, possession or the care and control of an animal

shall provide the animal with food, water, shelter and care in accordance with the regulations." However, under section 4(2) of Schedule A to the *General Regulation – Society for the Prevention of Cruelty to Animals Act*, no one may be found guilty of such an offence as long as he or she has complied with the *CCAC Guide to the Care and Use of Experimental Animals* (http://www.gnb.ca/acts/acts/s-12.htm).

Nova Scotia

The Nova Scotia Society for the Prevention of Cruelty (SPC) has the authority to inspect and monitor research laboratories, as well as breeders and suppliers of animals for experimental purposes. By means of regulations, the SPC may prescribe conditions governing the housing and care of animals kept for the purposes of sale, research or breeding. However, the conditions laid down may not conflict with the standards contained in the codes of practice recommended for the care and housing of farm animals published by Agriculture and Agri-Food Canada or the Agri-Food Research Council of Canada, nor may they contradict the CCAC guidelines. The regulations indicate that no prosecution may be brought against a person who complies with these codes and guidelines. While it has not yet been exercised, the Governor in Council of the province has the power to exempt any research conducted in accordance with a control system approved by the CCAC from the requirements laid down by the SPC (http://www.gov.ns.ca/legi/legc/statutes/animalcr.htm).

Ontario

The Ontario legislation, the *Animals for Research Act*, creates a system of control based on the registration of research facilities and the issuance of licenses for supply facilities. In Ontario, all research facilities that use animals in their work must be registered. Among the provisions of the *Animals for Research Act* is the duty to establish an ACC, and the requirement for any operator of a research facility to submit to the person designated by the Minister of Agriculture, Food and Rural Affairs a report respecting the animals used in the research facility for research. The regulation *Research Facilities and Supply Facilities* also provides minimum standards for the housing, and care of animals and the regulation *Transportation* prescribes the conditions for transporting animals used or intended for use by a research facility (http://192.75.156.68/DBLaws/Statutes/English/90a22_e.htm).

Saskatchewan

In Saskatchewan's *Veterinarians Act*, an exemption is given to researchers using animals at a university as long as an ACC that includes a veterinarian has approved the protocol (http://www.qp.gov.sk.ca/documents/English/Statutes/Statutes/V5-1.pdf).

2.3.3 Municipal

Some municipalities across Canada have passed a prohibition on the sale of pound animals to research laboratories.

Some municipalities have by-laws regulating the transport of animals, and these must be followed. Many municipal governments also have regulations governing the holding or use of wildlife within municipal boundaries. There are usually restrictions on the use of firearms and other weapons, and there may be regulations relating to the use of traps or other tools and vehicles.

2.3.4 International

Importation of animals for research purposes must meet the requirements of the Canadian Food Inspection Agency (CFIA).

The transportation of animals from the United States into Canada is controlled by the US Department of Agriculture's *Animal Welfare Act* (1966) (http://www.nal.usda.gov/awic/legislat/usdaleg1.htm).

CITES

The *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES), in force since 1975, has 169 member countries (as of 2007), including Canada. Member countries ban commercial trade in endangered species and regulate and monitor trade in other species that might become endangered. CITES applies not only to live animals, but also to "Parts and parts thereof", which includes all types of biological samples (skin, hair, bones, blood, serum, etc.) (www.cites.org).

The import or export of any animals on the CITES list requires a CITES permit from the Canadian Wildlife Service (CWS) and the appropriate import or export permit from the provincial or territorial agency responsible for wildlife. Some provincial/territorial wildlife authorities are also CITES permit-issuing authorities for that province or territory.

3 CONSIDERATIONS IN THE PROCUREMENT OF ANIMALS

All decisions related to the procurement of animals should be made long in advance of anticipated use, since testing, quarantine and breeding of stock can take months, depending on the species. Attempting to shorten the acquisition period due to time pressures can lead to poor choices that endanger both existing and introduced stock and associated research. In addition, the process to approve animal use through the ACC must take place before animals are acquired.

Guideline 8:

Prior to procurement of animals, consideration should be given to the type of animals required, the ability to house and care for those animals, and any potential impacts on other animals in the facility.

Potential sources of animals will be determined by the health status requirements of the studies in which the animals are intended to be used, as well as the conditions under which the animals will be housed. This is important both for the welfare of the animals and for the validity of the science.

3.1 Intended Use of the Animals

Where studies require animals with a high health status, the animals should be procured from very well defined and reliable sources. For example, some studies may require that farm animals be obtained from herds of known health status which have been tested for exposure to unwanted pathogens (e.g., Bovine Virus Diarrhoea Virus [BVDV] negative cattle) and/or vaccinated. Other studies will require very specialized health status, such as studies requiring Specific Pathogen Free animals that are defined by which pathogens are excluded (e.g., for studying Coxiella in sheep or Salmonella in poultry; or influenza-free animals for studying lung function), or gnotobiotic animals (e.g., for xenotransplantation or other studies requiring microbiologically naïve status).

Animals required for short-term (acute, non-survival) studies may have different health requirements than those used in long-term (chronic) studies. For example, if an animal is to be euthanized for tissue collection, the health requirements necessary to protect an existing population may be less than if the animal is to be housed for a period of time.

Where knowledge of an animal's history (e.g., nutritional background, disease exposure, etc.) is not necessary, obtaining animals from a random or unknown source may be acceptable. These animals are not recommended for most uses; however, they may be suitable for some studies, such as teaching and acute tissue collection. Possible sources of these animals are auction markets and from within or between cohorts or studies.

3.2 Availability of Facilities

Prior to the procurement of animals, consideration should be given to the available facilities, both in terms of the needs of the new animals and the impact on the existing animals when new animals are introduced. The previous housing conditions of the animals should also be taken into consideration. For example, sheep brought indoors may suffer from heat stress if they have been housed outdoors during the fall and winter.

New animals obtained and introduced must not compromise or otherwise endanger the biosecurity of existing colonies/herds/flocks or individuals of the same or other species. The ability to quarantine the animals on arrival should be considered, particularly in terms of space, facility design and staff, to allow quarantine for conditioning, vaccination, testing, etc. Alternatively, arrangements may need to be made to do this off-site.

If all-in/all-out flow of animals is possible, then the introduction of new animals is less risky in terms of introduction of pathogens to the existing population, or of infecting new arrivals with existing disease. Where there is a constant inflow of animals, the disease status of the animals

should be better defined through testing and quarantine, preconditioning by vaccination, etc.

The presence of other conspecifics in the same facility should be considered. For example, if only one researcher is using poultry, there is little concern about infecting other birds with avian pathogens; however, the presence of diseases that might be zoonotic or cross to other animal species (e.g., salmonella) must be considered.

3.3 Breeding or Raising Animals Internally Versus Out-sourcing

Some of the factors to be considered in determining whether animals should be bred or raised in-house or outsourced include:

- space available (depends on the number of animals required);
- facility suitability (e.g., ability to isolate from other animals);
- staff availability and knowledge of specific husbandry/breeding requirements;
- cost;
- amount of time required to raise the animals to an age suited to their intended use;
- availability of a reliable supplier that can provide animals on demand; and
- ability to contract out breeding or raising animals to needed age.

If the decision is made to breed animals internally, further consideration should be given to the desired breed characteristics and availability of animals. For example, domestic swine are not a uniform population in commercial production; there are multiple strains within breeds and the animals are highly selected for commercially desirable parameters such as fecundity, growth and carcass composition. In many situations, the logistics involved in breeding animals (e.g., space and animal care staff time) may be prohibitive.

4 SOURCES OF ANIMALS

Guideline 9:

Appropriate documentation must be maintained for all animals procured by an institution or its investigators.

Such documentation should include date of birth/age or date of arrival at source, specific source (e.g., in-house breeding stock, voluntary surrender by owner, etc.), shipment date, shipping weight (if applicable), breed/strain, health status, etc.

All cattle procured for scientific use must be tagged with a Canadian Cattle Identification Agency (CCIA) approved Radio Frequency Identification (RFID) tag. For more information, see http://www.canadaid.com/Producer/. There is also a mandatory tagging program for sheep through the Canadian Sheep Identification Program (http://www.cansheep.ca/english/id_rationale.htm).

4.1 Suppliers

Suppliers are commercial enterprises whose business is the sale of animals for scientific purposes.

Guideline 10:

Animals should be obtained from reputable suppliers.

Animals should be obtained from the most well-defined and characterized source possible. A reputable supplier is a supplier with whom the institution has a positive pre-existing relationship, or has been recommended by other institutions who have had a positive relationship and whose reputation is based on humane, safe and timely supply and transport of healthy animals. It is almost always preferable to obtain standard laboratory species from an established breeder or supplier. All commercial suppliers of laboratory animals, regardless of whether or not they come under provincial legislation, are expected to provide housing facilities and to follow animal care practices equivalent to standards required by CCAC guidelines.

Good relationships should be established between institutions and suppliers (see Section 2.2.2 Responsibilities of Institutions). Suppliers should, if requested, provide detailed information on health status monitoring, breeding and health practices followed, as well as the conditions under which the animals were previously housed.

In acquiring farm animals for use in research, teaching and testing, institutions should be aware that different genotypes have different environmental and management requirements which must be taken into consideration.

In cases where genetically-engineered animals are being acquired, it is both an ethical duty and a research necessity that the animals come from reputable suppliers or institutions. Additionally, reputable suppliers/institutions should be able to provide the information for completion of the genetically-engineered animal information document that is required by ACCs (see *CCAC guidelines on: genetically-engineered animals*, in prep.).

For procurement of wild animals, see section 4.9 Procurement of Animals from the Field.

4.2 In-house Breeding Colonies

Guideline 11:

In-house animal breeding colonies should only be established when absolutely necessary, and should be efficiently managed, consistent with anticipated need and the principle of reduction.

The decision to establish a breeding colony program in a research institution is one that the investigator and the ACC should always study carefully in terms of the nature of the project. Unless breeding is an integral, even essential, part of the scientific exercise, thorough evaluation must be undertaken of: 1) the ultimate numbers of animals that will have to be produced

versus the actual numbers that will be utilized; and 2) the cost to the institution of animals bred within the facility (including the occupancy of valuable and costly space which will no longer be available for other scientific purposes). Small in-house breeding programs almost always involve the need to dispose of animals superfluous to the needs of the project, and the maintenance of excess breeders in order to try to cope with fluctuating demands. Detailed records must be kept for all breeding colonies.

Animals involved in a breeding program must be housed and cared for according to the relevant CCAC guidelines (i.e. *Guide to the Care and Use of Experimental Animals*, volume 2 (1984); *CCAC guidelines on: the care and use of fish in research, teaching and testing* (2005); *CCAC guidelines on: the care and use of wildlife* (2003); *CCAC guidelines on: the care and use of farm animals in research, teaching and testing*, in prep.). It is essential that those working with the animals in a breeding program are knowledgeable of the anatomy, behaviour and physiology of reproduction for the animals concerned.

For the maintenance of a genetically-engineered line, large numbers of animals are often involved, requiring excellent colony management. Careful tracking of the numbers of animals produced and the number actually used can help managers reduce the numbers of surplus animals generated, and also avoid short-falls in the numbers of animals required for the research. The use of software should be considered to help with management (Hetherington et al., 2000).

Maintaining a genetically-engineered animal line by breeding heterozygotes produces non-genetically-engineered animals (the wildtype homozygotes), heterozygotes, and homozygotes. Unless the wildtype and heterozygotes are required for comparison to the mutant homozygote, this means surplus animals are generated. Therefore, in general it is preferable to maintain the genetically-engineered line through breeding homozygotes. However, where an adverse phenotype is observed or compounded in the homozygotic state, consistent with the research goals, maintaining the colony as hemizygotes or heterozygotes may minimize the effects of the compromised phenotype on the animals (Robinson et al., 2003).

4.3 Livestock from Farms and Auction Markets

Guideline 12:

Preconditioned animals should be purchased whenever possible.

When acquiring animals of unknown origin or from stockyards or farms, an assessment of the health status of the herd should first be made (FASS, 1999). Once the animals are obtained, they should be quarantined in accordance with established SOPs, in order to minimize the spread of diseases to other animals in the facility (see Section 6.3 Acclimatization and Quarantine).

Purchasing pre-conditioned cattle (weaned, castrated, de-horned, vaccinated at least 30 days prior to sale and having prior feed bunk experience) is recommended to reduce animal stress and ensure efficacy of vaccination.

As far as possible, institutions should purchase polled cattle that have not been branded. Both branding and dehorning are invasive practices that have a considerable impact on the long-term well-being of the animals (For example, see Goonewardene & Hand, 1991; Schwartzkopf-Genswein et al., 1997). Calves should not be purchased from sources that do not provide calves with sufficient colostrum. Where possible, total serum protein levels of calves should be determined by refractometer prior to purchase. Total serum protein at 24-48 hours of age should be >5.5g total protein/dL (Besser & Gay, 1994; Weaver et al., 2000).

4.4 Poultry from Commercial Operations

Institutions acquiring poultry from commercial operations should ensure that the standards of those operations meet the *Recommended Code of Practice for Chickens, Turkeys and Breeders from Hatchery to Processing Plant* (CARC, 2003; http://www.nfacc.ca/code.aspx).

The particular characteristics of the poultry required for the study should be identified, as broiler chickens are very different from laying hens. Over the past 25 years, the divergence in

selection pressure has made the biology, nutrition, behaviour, etc. of these birds quite different.

4.5 Animals from Pet Shops or Their Suppliers

Guideline 13:

In general, animals used for scientific purposes should not be obtained from pet stores or their suppliers due to the potential health risks associated with disease transmission and the potential health problems for these animals themselves.

The purchase of pet store animals for research purposes raises issues concerning the health of the animals, their genetic history, the potential for disease transfer and the need to quarantine and condition the animals prior to use; these must be addressed as part of any decision to source animals from the pet industry. The Pet Industry Joint Advisory Council of Canada (PIJAC) represents the pet industry, including pet stores, and has a specific code of practice in place to encourage the sale of healthy animals (http://www.pijaccanada.com/English/m_code_of_practice.cfm). These suppliers should also adhere to *A Code of Practice for Canadian Kennel Operations* (CVMA, 2007) and *Canadian Cattery Operations* (CVMA, in press).

In Ontario, it is illegal under the *Animals for Research Act* to obtain animals for research, teaching or testing from pet stores, unless a person wishes to purchase or otherwise acquire an animal for use in a research facility and the animals is not of a type that may be readily purchased or otherwise acquired under the Act by reason of its species or strain or by reason of any specific disease or condition desired of the animal.

4.6 Dogs and Cats

4.6.1 Purpose-bred Dogs and Cats

Guideline 14:

Dogs and cats specifically bred for scientific purposes must be the model of choice for studies where defined genetic, environmental and health statuses are necessary.

Purpose-bred animals should always be used for regulatory testing. The use of a purpose-bred animal with a well-defined health status keeps the number of animals to a minimum.

There is a significant body of background data for the beagle, which makes it particularly valuable as a defined research animal (Prescott et al., 2004). In addition, studies in which recovery is necessary should utilize purpose-bred dogs. However, purpose-bred animals may not be suitable for specific research studies because of the limited variety of breeds available. For example, the size of the particular breeds available may preclude their use in some studies.

4.6.2 Non Purpose-bred Dogs and Cats

Guideline 15:

Institutions must only obtain non purpose-bred dogs and cats where there is a well-defined arrangement with the management of the organization supplying them.

Non purpose-bred dogs and cats include animals that have been obtained from pounds and animal shelters, animals that have been loaned or donated to institutions for the purposes of training veterinary technicians and veterinary students, and dogs that have been obtained as surplus to other activities, such as racing or sled pulling.

Institutions must ensure that the animals from a pound or shelter have been held by the pound/shelter for at least 3 business days (not counting the day the animal is received or released) or longer if mandated by legislation. Institutions should require that animals be held for a further period of 4 days before use, preferably at the pound where there is exposure to the public and better opportunity for adoption. Upon request, institutions should return dogs that have not been used to the pound of origin if an owner is searching for a lost pet and wishes to examine an animal released for research purposes.

Institutions must ensure that both the pound and the institution maintain good records of the animals released to the institution, and that the impound facilities or shelters thoroughly check the animals for identification. Upon receipt, the

institution should receive written descriptions of any identification the animal has/had (tattoo, microchip, collar, tag) and note for each animal that efforts have been made to trace all identification. The animal should be again examined for identification that might have been previously missed, and all dogs and cats must be scanned with a reader capable of reading all types of microchips (see the CVMA website for more information, http://canadianveterinarians.net/Documents/Resources/Files/189_Annex%201_RequirementsToComply_Dec162005.pdf).

Animals from pounds have unknown genotypes, behavioural experiences and disease profiles. The pathophysiological changes that may be associated with parasitism, chronic infections and poor nutritional status frequently encountered in an unconditioned animal, constitutes an uncontrolled experimental variable. This may distort the results obtained and affect repeatability and interpretation (Sheets et al., 2000). Dogs that are obtained from suppliers as surplus to other activities may have a better defined genetic background and health status than other non purpose-bred dogs. However, some prior uses of these animals may mean that the dogs are not well socialized, and should be used only in procedures that do not involve significant handling of the conscious animal. Where animals are not well socialized, they should not be kept for long before use and should only be used for terminal procedures.

Institutions should be aware that, while non purpose-bred animals may be less expensive initially, they may incur higher costs due to the degree of conditioning required (see Section 6.2 Conditioning). Institutions must also be ready to answer questions from the public concerning the use of theses animals, recognizing that this is an area of particular public concern.

4.7 Procurement of Animals from Another Institution or Animal User

When considering the procurement of animals from another scientific institution or from another animal user within the same institution, a request should be made for documentation detailing the original source of the animal and the history of the animal while in captivity (e.g., conditioning, housing, nutrition, previous use in research, etc.). For transfers between institutions, a health certificate for the animals should be provided, and the animal care services at the receiving institution should be notified of the transfer and be given a copy of the health certificate. These animals should only be procured if they are suited to their intended use and to the conditions under which they will be housed, and they have not been subjected to procedures that would preclude their use (see Section 4.8 Animals from Other Studies).

4.8 Animals from Other Studies

Guideline 16:

Animals subjected to invasive surgery must not be used in additional studies, without explicit approval of the animal care committee.

Occasionally, animals that have been used for a study and have not been subjected to invasive procedures may be used for a further scientific study. As well, a second major surgery may be performed on an animal if it is a non-survival procedure. Minor procedures such as biopsies may be performed more than once, but only if they can be done with effective anesthesia and analgesia and do not significantly impact the well-being of the animal. Complete recovery between procedures is recommended if possible.

4.9 Procurement of Animals from the Field

For collection of any animals from the field, investigators should observe and pass on to students and employees a strict ethic of habitat conservation and respectful treatment of the animals. Research goals will generally dictate the appropriate sampling method; however, investigators should select the method that has the least impact on the animals and on the local ecosystem, and is the safest for all concerned.

Before initiating field projects involving capture, investigators must have obtained the necessary permits and must be familiar with the study species and its response to disturbance, as well as its sensitivity to capture and restraint. In addition, investigators should be familiar with the advantages and drawbacks of available methods of live capture, particularly those that have been

used with the study species. Investigators should ensure that the capture method used is effective and suited to the species and situation, will minimize distress and injury to the study animals, and will minimize capture of non-target species. In addition, the investigator should be trained in the correct use of the selected method or technique and should be able to ensure the prompt release of any non-target animal that may be accidentally captured.

Investigators should also take measures to avoid the removal of animals with dependent young from the wild. The use of live lure animals should be avoided, but if they must be used, investigators are also responsible for their well-being and must take care to minimize their level of distress.

Before initiating the capture of wildlife, consideration should be given to the fate of the animals following the study, and steps should be taken to ensure that the welfare of the animals and other practical issues, such as regulations, are properly addressed.

For more information, see *CCAC guidelines on: the care and use of wildlife* (2003), and *CCAC guidelines on: the care and use of fish in research, teaching and testing* (2005).

4.10 Use of Privately Owned Animals

In some situations, animals used in research are not actually acquired or procured, but rather owned by private farmers, pet owners, etc. These animals may be involved in clinical or in situ research.

5 TRANSPORTATION

The objective of any method of transportation is to ensure the safety, security and comfort of the animal, while moving it efficiently to its destination. Adherence to principles of humane transportation and handling during the transport period and on arrival at the institution should help ensure that, when the animal is used in research, teaching or testing, the results are meaningful and scientifically valid. This section is based on recommendations made by the US National Research Council *Guidelines for the Humane Transportation of Research Animals* (ILAR, 2006) and the UK Laboratory Animal Science Association *Guidance on the transport of laboratory animals* (Swallow et al., 2005). These two documents should be consulted for more detailed information on best practices for the transportation of animals.

Transportation can result in significant stress for the animals, and have a significant impact on the animals' welfare. Swallow et al. (2005) provide a list of potential sources of stress for animals being transported. Transportation stressors can be categorized as physical (changes in temperature, humidity, or noise), physiological (poor access to food and water), and psychological (exposure to novel individuals or environments). It should be recognized that even the movement of animals within a building or institution can be stressful to the animals and to humans. Such local transport must be minimized and requires adequate planning and the implementation of appropriate equipment and procedures. Most transportation events are considered as acute stress events, the effects of which do not last more than a few days. However, care must be taken to minimize post-trip stress that may lead to a chronic stress event.

All animals in transit should be accompanied by the appropriate documentation. Such documentation should be consistent with the regulations where applicable (e.g., livestock manifests). Where the animals will be transported across international borders, knowledge of the appropriate procedures and documentation is essential to preventing unnecessary delays.

Guideline 17:

A Standard Operating Procedure should be developed for the transportation of animals by the institution, its investigators or its employees.

Institutions, in consultation with animal users (particularly for protocols using nontraditional or field species), are responsible for selecting the method and timing of transportation of animals from the suppliers, and monitoring the transportation process. An SOP should be in place to address actions to be taken in the event of an accident, breakdown or other unforeseen complication. If animals are to be transported by a commercial transporter, a written agreement or similar documentation should be prepared in advance.

Prior to transporting animals from the supplier to the facility, the procedures involved should be determined to be appropriate for the species and to be humane (IATA, 1995). Animal care staff should be notified of the shipment, as well as the expected delivery date and time. Standard Operating Procedures (SOPs) should describe the management and site of receipt of animals at the institution; this is particularly important in those institutions where animals are not delivered directly to the animal facility but to a central receiving area. These SOPs should also detail procedures for animals arriving unexpectedly or after normal working hours. Attention to the health documentation at the importing institution is mandatory.

It is essential to make appropriate pre-arrangements concerning the transport of the animals in order to minimize the length of time they spend in transit. Where possible, animals should be acclimatized to the containers, the mode of transport, and the food and water that will be provided during transport. The transportation route should be planned from loading to unloading in order to minimize journey time, and any potential delays should be considered. Measures should also be taken to minimize sudden movements, excessive noise and vibration during

transport. Frequent human handling before transportation may help animals to react more positively to this stressful situation.

Prior to sending the animals, they should be examined and found to be fit for transport. Animals that are sick or injured should not be transported, unless it is determined that: 1) transport will not cause additional welfare problems; 2) the animals are being transported under veterinary supervision for, or following, veterinary treatment; or 3) the animals are being transported for scientific purposes approved by the ACC, and particular attention has been given to any additional care which may be required. However, it should be noted that this does not remove liability under the various animal transportation regulations.

If pregnant animals or animals with young are to be transported, they should be given special consideration, appropriate for the species.

Personnel affiliated with the institution or study who are involved in transporting animals should be knowledgeable of the species-specific requirements of the animals, and should receive training in good handling practices to facilitate the loading and unloading of animals. Personnel must also receive training in the husbandry and environmental requirements of animals to be transported.

Transportation of animals in private vehicles is discouraged due to: the lack of control over vehicle safety and appropriate set up for transport (e.g., cages, location, tied down, open vehicles, etc); the risk of disease transmission from pets that may have been in the vehicle; the risk to the reputation of the investigator or institution should there be an accident; and the possible insurance risk for driver if the animal(s) escape or there is exposure to the public.

Guideline 18:

Those overseeing the transportation of animals must be knowledgeable about the specific container requirements, temperature and ventilation of both the container and the environment during transportation, care of the animals prior to and during transport, and the requirements for labelling and documentation.

As well as minimizing stress to the animals, containers should also prevent or restrict the entry or spread of micro-organisms, as appropriate. The International Air Transport Association (IATA) produces the *IATA Live Animal Regulations* annually, which include information concerning documentation, containers and other requirements for humane transportation of live animals (www.iata.org). While the IATA specifically provides information for air transportation, this information is also useful for land transportation. Additional information on species-specific containers, numbers of animal per box, and care during transport (including food, water sources, etc.) can be found in Swallow et al. (2005) and ILAR (2006).

The space allocation recommended for animals during transportation differs from the space recommended in an animal facility. Various factors, such as animal behaviour, social interaction, thermal environment, and species-specific requirements, influence the space that must be allocated. If too much space is allocated, animals can fall and be injured, or even killed. If too little space is allocated, animals can pile up on top of one another, leading to injury or suffocation. Space requirements also depend on whether animals are to be transported individually or in groups, and whether these animals normally stand or lie down during the journey. Isolation can minimize social stress in solitary animals, but may cause stress in animals that prefer being in groups (Tamashiro et al., 2005). Most laboratory and farm animals are social animals and are usually housed in groups. If animals are to be transported in groups, they should be grouped prior to transportation in order to establish a dominance hierarchy in advance of the journey. Efforts must be made to ensure grouped animals are compatible.

The need to provide feed and water prior to and during transportation will depend on the species. Those overseeing the transportation process should be aware of the requirements for the animals involved. Provision of feed or water during transportation may cause some problems such as food spoilage and water spillage. In turn, the water spillage may cause the wetting of the floor and lead to injuries. Animals may not have the ability or the motivation to eat while the vehicle is in motion. Provision of food or water may not have any benefit to animals during short trips, and provision of food and water during

long trips requires special attention. For example, rabbits and rodents should have feed and water prior to and during transport, while dogs and cats should not be given feed or water for 4 hours prior to transport and should only be fed and watered at intervals of 24 hours and 12 hours, respectively, during transport. In addition, small animals lose more heat and more calories, and become dehydrated more quickly than larger animals. The amount of feed and water available should be twice that required by the animals for the anticipated length of travel in order to accommodate delays. Consideration should be given to the use of commercially available food/water packs prepared for the transportation of certain species.

The transport of farm animals should be in accordance with the *Recommended code of practice for the care and handling of farm animals – Transportation* (CARC, 2001; http://www.nfacc.ca/code.aspx), and must be in compliance with Part XII of the *Federal Health of Animals Regulations* (http://laws.justice.gc.ca/en/H-3.3/C.R.C.-c.296/). In addition, pro-vincial/territorial laws and regulations regarding livestock transportation must be followed. It is recommended that calves should not be transported or brought into the facility before they are one week of age (see *CCAC guidelines on: the care and use of farm animals in research, teaching and testing*, in prep.). Facilities for loading and handling sheep and goats should be designed specifically for them, as injuries will likely result if facilities designed for cattle are used.

For aquatic species, special considerations are required for transportation in an aqueous or moist/humid environment, depending on the species. For example, methods to maintain a moist environment should be employed for transporting amphibians. *Species-Specific Recommendations on Amphibians and Reptiles* (www.ccac.ca), which accompany the *CCAC guidelines on: the care and use of wildlife*, should be consulted for additional information. As well, the *CCAC guidelines on: the care and use of fish in research, teaching and testing* (CCAC, 2005) describes some of the requirements for transportation of fish, including methods to maintain the relevant degree of aeration of water for prolonged transport, and the amount of water/degree of salinity relevant to the species and density.

For transportation and movement of genetically-engineered animals from one facility to another, particular regulatory requirements must be met (see *CCAC guidelines on: genetically-engineered animals*, in prep.). Genetically-engineered animals may have specific welfare issues with respect to transport, and in such cases, alternatives such as shipping embryos should be considered. When genetically-engineered animals are transported, additional resources and personnel may be required, compared to the transport of conventional animals.

Considerations for the transport of wildlife may be found in the *CCAC guidelines on: the care and use of wildlife* (2003).

Guideline 19:

All Standard Operating Procedures regarding the transportation of animals must include instructions describing emergency responses, in line with the mode of transportation to be used.

Emergencies can occur at any time during transportation. These emergencies can be caused by extended delays before the start of the transportation; by exposure of the animal to extremes of temperature; as the result of animal escapes; or as a result of mechanical problems with the transport vehicles. Both a primary plan and a backup plan should be available for each phase of the transportation process. Comfortable accommodations should be in place at all times.

An event may arise in which it must be decided whether to anesthetize or euthanize an animal because of the level of pain and/or distress experienced by the animal, or the potential for injury to the human handlers. The emergency procedure plan should identify trained and qualified personnel who are responsible for making and enforcing emergency decisions, and specify the methods and equipment to be used for the anesthesia or euthanasia of animals if needed during a transportation event.

Personnel who are handling animals must be trained appropriately in routine and emergency procedures that are species-specific and specific for the mode of transportation. Personnel must also be trained to recognize physiological signs that may indicate a problem in a single animal or in a group of animals.

6 RECEIVING ANIMALS

Guideline 20:

Institutions receiving animals should be prepared for accepting the animals by providing proper facilities and appropriate handling by trained, experienced personnel.

6.1 Documentation

Guideline 21:

Institutions should be responsible for ensuring records are kept for all animals received.

Animals' records should include the source of the animals, date of arrival, condition of animals upon receipt (including any deaths), number upon arrival reconciled with number ordered/expected, and where possible, information on their health status. Where appropriate, institutions should also obtain and record detailed information on the rearing methods, husbandry (feeding and grouping) and previous treatments performed (e.g., beak trimming, tail docking, etc.).

Genetically-engineered animals that are brought into an institution should have accompanying documentation, which includes the genotype, phenotype, information on welfare concerns and health status.

6.2 Conditioning

Guideline 22:

Institutions should have Standard Operating Procedures for conditioning animals upon receipt that take into account the species and background of the animals.

The aim of a conditioning program is to ensure that the animals are suitable to begin the research, teaching or testing. The degree of conditioning required will depend on the species and the measures taken prior to transporting the animal to the institution.

Animals entering the facility's receiving area should be unloaded and carefully screened. Unsuitable animals should be euthanized immediately using species appropriate methods (see *CCAC guidelines on: euthanasia*, in prep.), or moved to another facility for use in acute studies (see section 4.6.2 concerning animals received from pounds). If found to be unsuitable, pound-sourced animals should be euthanized only once the appropriate holding time-period has elapsed, unless the animals are found to be suffering from unrelievable pain or distress. Animals that are retained should be moved to the examination area, or in the case of fish, moved to a quarantine tank (see *CCAC guidelines on: the care and use of fish in research, teaching and testing*, 2005).

Animals other than fish should be given a complete physical examination. Fish should be monitored and tested in the quarantine tank to determine their health status. If the animals have been obtained from a pound, they must also be scanned for identification.

All animals should be given appropriate identification. A health record appropriate for the species should be created containing species-relevant information (which may include animal description, age, sex, weight, source, results of physical exam, vaccination history, results of parasite screening, treatments given and any other comments relating to the animal's health or temperament).

Where appropriate, vaccination and parasite control treatments should be administered, as well as other treatments such as nail or hoof trimming.

For animals such as dogs, socialization, habituation and training, as described by Prescott et al. (2004), are important components of the conditioning process. Socialization to humans and conspecifics, combined with habituation to the environment and training, improves the animal's ability to cope with the research setting, resulting in positive implications for both the welfare of the animal and the research data collected.

6.3 Acclimatization and Quarantine

Guideline 23:

After transportation and before use in any experiments, animals should be acclimatized to the experimental conditions.

All animals should be brought into clean facilities and undergo a period of acclimatization to their new facilities prior to being included in any research project; this can include the quarantine period. When new animals are brought in, normally they should be quarantined prior to introducing them to other animals. A combined approach for acclimatization and quarantine should be used as far as possible, so that both are accomplished simultaneously.

The period for acclimatization of each animal varies, and therefore, knowledge of the species and of the individual animals is essential. The time required for the animals to adapt to the laboratory environment will depend on the species and prior experience (including the degree of handling and the nature of any confinement). A longer period of adjustment/training must be considered if animals are not accustomed to handling or observation prior to entering the institution.

Newly acquired animals should normally be held in enclosures using an "all-in/all-out" system of management. The animals should be housed according to the species-specific requirements. If an animal appears ill, it should be removed from the holding room and placed in isolation. It should be observed several times during the day and treated in consultation with the attending veterinarian. If its condition appears to be infectious, the animal should be euthanized and sent for necropsy. The remaining animals from the original holding room should be held for an additional period for observation purposes.

When farm animals or wildlife are brought into indoor heated housing, consideration must be given to the transition from the ambient conditions (e.g., cold weather, photoperiod, etc.), so that the transition is as smooth as possible for the animals. Consideration should also be given to any changes in diet or food sources offered to wildlife species that differ from those available in the wild and the appropriate acclimatization to such changes. Bringing animals in from the cold results in physiological changes that will also be reflected in changes in their dietary requirements. Husbandry procedures, such as shearing sheep or clipping of an excessively long hair coat (dairy cattle), will help to acclimatize the animals to a warmer environment. Hooves should be trimmed if overgrown or unbalanced.

Changes to diet may also be an important consideration, particularly for dogs, cats and livestock. In livestock, a rapid change of feed can cause severe problems (diarrhea, bloat in cattle, etc.). Maintaining the animals upon arrival on a diet consistent with prior feeding, and implementing any change gradually during the conditioning period can help avoid such problems.

Guideline 24:

Quarantine areas should be subject to extra vigilance in monitoring the animals and in maintaining good records, in order to detect and respond to any health problems in quarantined animals.

Guideline 25:

Duration of quarantine should be appropriate to ensure that the health of the animals under quarantine and that of the conspecifics already resident at the research facility is assured.

The purpose of quarantine after receipt of animals is to isolate the animals from the main populations in the facility, in order to permit careful observation and health screening until the newly arrived animals are deemed to be healthy and free from communicable disease. Thereafter, these animals can be integrated into the herd/flock or placed on experiment.

Minimum quarantine times should be established in consultation with the veterinarian, based on the anticipated time frame for expression of the pathogens of concern. New stock animals should undergo routine health screening if they are to be mixed with existing stocks.

Quarantine areas should be managed according to rigorous infectious agent control practices, and personnel should be sufficiently trained in these practices. SOPs should be in place in order

to implement infectious agent control practices. Particular vigilance should be paid to practices such as effluent disinfection, dedicated accessories, etc., in order to avoid the potential transfer of pathogens to the main areas of the facility or to the environment outside of the facility itself.

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8 GLOSSARY

Acclimatization — a persisting physiological, biochemical or morphological change within an individual animal during its life as a result of a prolonged exposure to an environmental condition such as a high or low temperature; generally, the changes are reversible.

Ambient conditions — the environmental conditions surrounding the animal; under caging conditions may refer to the temperature, humidity, etc. in the microenvironment inside the cage as opposed to temperature outside the cage in the room or enclosure.

Biosecurity — the prevention of animal infections and infestations from entering a unit from outside sources; biosecurity is achieved through the use of exclusion barriers.

Biotechnology — the use or development of techniques using organisms or parts of organisms to provide or improve goods or services.

Breed — (noun) a population of animals within a species, which differs from those in other populations within the same species in respect to definite genetically determined traits; (verb) to cause to reproduce, as in controlled mating and selection.

Conditioning — term applied to examination and preparation of animals for research.

Distress — a state of excessive stress in which the animal is unable to make the necessary adaptations to stressor(s).

Ecosystem — a complex of the plant and animal communities within an area, along with the nonliving components of the environment and the interactions among these.

Embryo — the early or developing stage of any organism, especially the developing product of fertilization of an egg.

Ethics — a system of moral principles or standards governing conduct.

Euthanasia — literally, a good death; rapid loss of consciousness and death, with no pain or distress accompanying the procedure.

Genetically-engineered animals — animals in which there has been a deliberate modification of the genome either via a technique known as transgenesis (when individual genes from the same or a different species are inserted into another individual) or by the targeting of specific changes in individual genes or chromosomes within a single species, i.e. targeted removal of genes (knock-outs) or targeted addition of genes (knock-ins).

Gnotobiotic animal — an animal in which only certain known strains of bacteria and other microorganisms are present.

Humane — conditions which promote physical and behavioral well-being of animals; in the case of euthanasia, humane methods are those which are painless, minimize fear and anxiety, and are reliable, reproducible, irreversible, simple, safe and rapid.

Pain — an unpleasant sensory and emotional experience associated with actual or potential damage, or described in terms of such damage (International Association for the Study of Pain®, http://www.iasp-pain.org/terms-p.html).

Pathogen — an organism which causes disease.

Protocol — a written description of a study or activity that includes details of the goals, the use of animals, the procedures that are to be followed and the personnel involved; the purpose of the protocol is to ensure the quality and integrity of the study or activity.

Quarantine — the segregation or isolation of animals from others to prevent the spread of disease.

Restraint — holding or securing to reduce activity in order to prevent the animal from causing harm to itself or harm to the handler.

Standard Operating Procedure (SOP) — written documents specifying procedures for routine activities that must be followed to ensure the quality and integrity of the study.

Stock — a collection of outbred animals being grown or maintained for breeding or for experimental use.

Stress — a strain upon the normal physiological or psychological processes or functions of the body, organ or tissue. Some stresses may cause pathology or diseased states, or weaken the normal body defences.

Supplier — commercial enterprises whose business is the sale of animals for scientific purposes.

Welfare — a term used to describe the quality of life that an animal is experiencing.

Well-being — a state or condition of physical and psychological harmony between the organism and its surroundings. Good health and manifestation of normal behavioral repertoire are the most commonly used indicators of an animal's well-being.

Zoonotic — relating to the transmission of a disease from a non-human species to humans.