Canadian Council on Animal Care
Conseil canadien de protection des animaux

Good Animal Practice in Science
Bonnes pratiques animales en science

Application of the Three Rs in Agricultural Research and Teaching –

CCAC guidelines on: the care and use of farm animals in research, teaching and testing

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Introduction

The Canadian Council on Animal Care (CCAC) system of oversight is based on the Three Rs tenet of Russell and Burch (Replacement, Reduction, Refinement; Russell & Burch, 1959). For the CCAC this fundamental ethic of animal experimentation is expressed in the *CCAC policy statement on: the Ethics of Animal Investigation*[‡] (CCAC, 1989).

The original Russell and Burch text focused primarily on the more commonly used laboratory species, i.e. mice, rats and rabbits, housed in animal facilities and being used for biomedical research or fundamental biological research. The CCAC oversees the care and use of all species of animals involved in research, teaching and testing, and develops guidelines in order to assist both investigators and animal care committee members to implement appropriate standards for housing, husbandry and procedures at the local level. In order to fully address the ethical concerns involved in certain types of research, teaching and testing, more specific guidelines documents are developed; for example, *CCAC guidelines on: the care and use of wildlife* (2003) and *CCAC guidelines on: the care and use of fish in research, teaching and development* (2005). During the preparation of both these documents, the subcommittees involved in their development spent a substantial amount of time considering the application of the Three Rs. Each subcommittee agreed that while the Three Rs continue to be applicable as the fundamental ethic of animal experimentation concerning both the use of wildlife and the use of fish, there are factors that require additional consideration within the context of these different uses.

The CCAC is currently developing *guidelines on: the care and use of farm animals in research, teaching and testing*. As part of this exercise, the CCAC subcommittee on farm animals[1,2] (CCAC, 1989) has spent some considerable time discussing the application of the Three Rs in the environment of agricultural research and teaching involving livestock species.

The CCAC and the Three Rs

Internationally, an assumption of the present day approach to the ethics of the use of animals by humans is that the use of animals in science forms a special class of animal use that deserves its own assessment criteria, which includes the Three Rs (Replacement, Reduction and Refinement; Colditz, 2006).

The tenet of the Three Rs, first outlined by Russell and Burch (Russell and Burch, 1959), is now enshrined in legislation regulating the use of animals for scientific purposes in several countries. In Canada, where there can be no federal legislation in this area because of the constitutional division of power (Wilson, 1998), the CCAC as the national quasi-regulatory body has incorporated this tenet into its fundamental policy document, the *CCAC policy statement on: the Ethics of Animal Investigation*[‡] (CCAC, 1989).

[‡] The use of animals in research, teaching, and testing is acceptable ONLY if it promises to contribute to understanding of fundamental biological principles, or to the development of knowledge that can reasonably be expected to benefit humans or animals.

Animals should be used only if the researcher's best efforts to find an alternative have failed. A continuing sharing of knowledge, review of the literature, and adherence to the Russell-Burch "3R" tenet of "Replacement, Reduction and Refinement" are also requisites. Those using animals should employ the most humane methods on the smallest number of appropriate animals required to obtain valid information.

Application of the Three Rs in agricultural research and teaching

Institutions which are involved in research and teaching relating to the agricultural industry usually maintain herds and/or flocks of animals in a semi-commercial farm environment. In addition, research is often carried out using commercial herds not otherwise associated with the institution. This situation places the ethics of animal use outside of the conventional "experimental use" and merits consideration of different issues in relation to the implementation of the Three Rs.

Replacement

Fundamental to the ethical importance of the Three Rs to research involving animals is the principle that animals may only be used for research if there is no other way of obtaining results anticipated from an experiment (Nuffield Council on Bioethics, 2005).

> The use of animals, including farm animals, for research, teaching and testing is acceptable only if it contributes to the understanding of fundamental biological, behavioural or agricultural principles, or to knowledge that can be expected to benefit humans, animals or ecosystems. Evaluation of proposals must attest to the potential value of studies involving farm animals.[3]

In the interests of sound science, investigators should explore alternative models to animal use in agricultural research, teaching and testing, in particular where there are limited benefits anticipated from the work or where a greater degree of confinement or pain and/or distress than would be otherwise experienced during the animals lifespan is anticipated. In some instances, for example the use of animals to teach certain procedures, the replacement of animals with dummies to facilitate skill development prior to practicing on the animal may be appropriate.

However, there are many types of research carried out in support of the agricultural industry - for example: to acquire knowledge to improve livestock husbandry systems; to improve attainment of breeding goals; to understand epidemiological patterns; and to improve attainment of commercial goals (Colditz, 2006). All of these require the use of animals, and where the animals are the beneficiaries of the research, or where the research goal is to improve the productivity of the animal, replacement may not be an appropriate goal (Colditz, 2004).

Reduction

> The numbers of animals maintained by an institution should not exceed the number that the facility can successfully house and care for.[3]

Reduction of animal use may not be appropriate in agricultural trials where treatment of the animal is at the herd level and is non-invasive. Where the impact of the study is uncertain, or expected to have a negative impact on the animal, the fewest animals appropriate to provide valid information and statistical significance should be used. Consultation with biometricians and use of known measures of variability, should assist in providing a good estimate of the number of animals required to test a given hypothesis at a specific level of significance and with a pre-determined level of statistical power (Petherick & Kilgour, 2001).

Institutions which are involved in research and teaching relating to the agricultural industry usually maintain herds and/or flocks of animals in a semi-commercial farm environment.

Where animals are used to train students, care should be taken to use sufficient numbers of animals so that the welfare of individual animals is not impacted by too many repetitions of the procedure. In addition an appropriate plan to retire the animals from teaching protocols, to ensure that they are not overused, should be in place.

Refinement

> Farm animals can experience pain and distress. Investigators and those responsible for the care of animals have an obligation to mitigate or minimize potential pain and distress whenever possible and in a manner consistent with good scientific practice.[3]

In addition to considerations of the benefit to be gained from a project, CCAC requires that protocols are refined so that the impact of the study on the animals is minimized through the use of best practices, and that the well-being of the animal is maximized through sound housing and husbandry practices.

The *CCAC guidelines on: the care and use of farm animals* place considerable emphasis on the improvement of the quality of life[4] for the animals used in research, teaching and testing. However, this is balanced by the need for purpose-oriented assessment, focusing on the particular constraints for animals in the research, teaching and testing environment (Rushen & De Passille, 2005). Research and teaching institutions are expected to play a leadership role in the implementation of best practices and should be able to monitor key indicators of welfare as a demonstration of the effectiveness of approaches towards refinement.

Summary

In developing the CCAC guidelines on: the care and use of farm animals in research, teaching and testing careful consideration has been given to the relevance of the Three Rs to an area of animal use by humans broader than the use of animals for biomedical science or fundamental biological research. The guidelines aim to provide information for investigators, animal care committees, facility managers and animal care staff that will assist in improving both the care given to farm animals and the manner in which experimental procedures are carried out (Refinement). Also in line with other CCAC guidelines documents (concerning wildlife and fish), the relevance of Replacement and Reduction strategies has been addressed. Careful consideration to model selection is important when animals are readily available on-site, and careful consideration of the appropriate number of animals for a study is also necessary, in particular where procedures may be more invasive than normally encountered during the life-cycle of the animal.

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Footnotes

1 The following are members of the CCAC Farm Animals Subcommittee:

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Dr. Laurie Connor, University of Manitoba
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Dr. Ian Duncan, University of Guelph
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Dr. Jeff Rushen, Agriculture and Agri-Food Canada, Agassiz
Dr. Fred Silversides, Agriculture and Agri-Food Canada, Agassiz
Dr. Kim Stanford, Alberta Agriculture Food and Rural Development

2 Process of guidelines development:

The CCAC is a peer based organization involving scientists, veterinarians and community representatives at all levels of its operation. Guidelines are developed by subcommittees of experts, peer reviewed by additional pools of experts, both nationally and internationally, and subject to a wide-spread review involving representatives of institutions that participate in the CCAC Program and any other parties likely to be affected by the guidelines

3 Statements drawn from the draft *CCAC guidelines on: the care and use of farm animals in research, teaching and testing*

4 The *CCAC guidelines on: the care and use of farm animals* include a description of animal welfare, recognizing that this term does not lend itself to a precise definition (Duncan & Dawkins, 1983; Fraser, 1995) but arose in society to express ethical concerns about the treatment of animals (Duncan & Fraser, 1998). It is a term that is used to describe the quality of life that an animal is experiencing, and is largely dependent upon the satisfaction of an individual animal's own physical, psychological and social needs.

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