

# The Use of Genetically-engineered Animals in Science: Perspectives of Canadian Animal Care Committee Members

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**Summary** — The genetic engineering of animals for their use in science challenges the implementation of *refinement* and *reduction* in several areas, including the invasiveness of the procedures involved, unanticipated welfare concerns, and the numbers of animals required. Additionally, the creation of genetically-engineered animals raises problems with the Canadian system of reporting animal numbers per Category of Invasiveness, as well as raising issues of whether ethical limits can, or should, be placed on genetic engineering. A workshop was held with the aim of bringing together Canadian animal care committee members to discuss these issues, to reflect on progress that has been made in addressing them, and to propose ways of overcoming any challenges. Although previous literature has made recommendations with regard to *refinement* and *reduction* when creating new genetically-engineered animals, the perception of the workshop participants was that some key opportunities are being missed. The participants identified the main roadblocks to the implementation of *refinement* and *reduction* alternatives as *confidentiality*, *cost* and *competition*. If the scientific community is to make progress concerning the implementation of *refinement* and *reduction*, particularly in the creation and use of genetically-engineered animals, addressing these roadblocks needs to be a priority.

**Key words:** animal research, genetically-engineered animals, reduction, refinement, stakeholder attitudes.

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## Introduction

In the past decade, several articles have been published on the welfare of genetically-engineered (GE) animals and potential challenges to the Three Rs principles of *refinement* and *reduction* (1–4). The challenges highlighted included: the invasiveness of the procedures involved in the generation of GE animals, the potential for unanticipated welfare concerns when generating new GE animal lines, and the numbers of animals required in order to establish new GE animal lines. In Canada, there have also been issues associated with the reporting of animal numbers and the severity classification of protocols involving GE animals. Additionally, it has been acknowledged that there needs to be a discussion about whether ethical limits can, or should, be placed on genetic engineering (5).

A decade ago, Robinson *et al.* (6) published a key paper on how the principles of *refinement* and *reduction* might be applied when generating new GE animals (mice, in particular). In addition to the overarching implication that the invasiveness of procedures for genetic engineering should be

minimised wherever possible, several specific recommendations were made, including:

- “the use of PCR [polymerase chain reaction] should always be considered, particularly for the routine genotyping of breeding colonies” (p. 28);
- “cryopreservation of embryos and gametes should be used” (p. 38);
- “unnecessary production and use of GM [genetically-modified] mice should be avoided. This requires a thorough search of subject-specific and specialised databases” (p. 45);
- “training should be provided to all relevant personnel on a range of animal husbandry issues”, including genetics and breeding programmes (p. 14);
- “records of the transgenic process should be maintained and compared with colleagues and benchmark figures, so that performance can be reviewed” (p. 15); and
- “results of all welfare assessments should be recorded and disseminated to all relevant persons involved in using and caring for the [ani-