Ethics and Transgenesis: Toward a Policy Framework Incorporating Intrinsic Objections and Societal Perceptions

Miranda Gott[1] and Vaughan Monamy[2]

[1]New South Wales National Parks and Wildlife Service, Hurstville, New South Wales, Australia; [2]Centre for Environmental Restoration and Stewardship, Australian Catholic University, North Sydney, New South Wales, Australia

Summary — Concerns about the use of transgenic animals can be broadly separated into extrinsic factors, such as risks to human and non-human health, environment, economy and society, and intrinsic factors, such as spiritual, cultural, moral or otherwise personal beliefs about humans, animals and Nature. We examine the bases for making ethical decisions about the use of transgenic animals and the intrinsic beliefs that underpin common objections to their use. We explore the need for a policy framework based on a utilitarian approach to ethical decision-making, which balances costs with benefits, but which also acknowledges the intrinsic beliefs that lie at the core of much opposition to genetic modification of animals. In particular circumstances, intrinsic objections may lead to a society refusing to condone transgenesis regardless of the weight of benefit promised from proposed uses. In sensitive subject areas such as regulating the use of transgenic animals, public policy is hard-pressed to keep up with the rapid pace of technological change. We advocate the use of dynamic processes that are capable of reflecting shifting public attitudes.

Key words: *ethics, intrinsic objections, policy, societal perceptions, transgenesis.*

Address for correspondence: *M. Gott, New South Wales National Parks and Wildlife Service, P.O. Box 1967, Hurstville, New South Wales 2220, Australia.*
E-mail: *miranda.gott@npws.nsw.gov.au*

Introduction

Transgenesis is the deliberate addition of DNA from one species into another species. The purpose of much transgenic animal research involves protection from heritable disease or the improvement of domestic livestock productivity. In the past ten years, the use of animals for research into transgenesis and cloning has increased exponentially. In 1992, transgenic research involved less than 1% of laboratory animals worldwide, while in 2001, 20% of research protocols involving animals were in transgenic areas (1). It has been predicted that, by 2005, total numbers of research animals used in experiments will begin to increase for the first time since 1975, reflecting the enormous upsurge in transgenic research (2).

The numerous concerns associated with research, production, uses and welfare of transgenic animals can be broadly separated into those based on:

— extrinsic factors such as health, environmental, economic and social risks; and

— intrinsic factors such as spiritual, cultural, moral or otherwise personal beliefs about animals and nature, and the relationship of human beings with animals.

Intrinsic objections are based heavily on beliefs rooted in personal experience. Hence, we argue that identifying a set of widely acceptable beliefs that could usefully and consistently contribute to public policy development and regulation of animal transgenesis is difficult, but nonetheless, useful. Additionally, we advocate the development of dynamic processes for reflecting shifting public attitudes to the use of transgenic animals in the regulation of their practical use. In doing so, we address the following questions:

— What is the basis for ethical decision-making about the use of animals?

— What are the beliefs that underpin common objections to the use of transgenic animals?

— How important are intrinsic beliefs in engendering opposition to transgenesis?

— Is transgenic animal production ethically different from the production of non-transgenic animals?

— What can be learned from the application of a utilitarian approach to decision-making about transgenic animal use that includes intrinsic beliefs?

— How can we construct policy frameworks for the use of transgenic animals that acknowledges intrinsic beliefs as well as extrinsic factors?

Preference Utilitarianism and Ethical Decision-making

When faced with decisions that require moral reflection, such as those regarding societal uses of animals, we often take an approach that is akin to preference utilitarianism. Simply put, it is an approach based on the relative weight of benefits that will be gained by a particular animal use compared to harm that will be done by that use, often with preference given to human needs and wants. Our decision-making may include intrinsic objections to certain uses and is tempered by levels of sentience that we attribute to, and empathy that we may feel for, the species of concern. Species with status as companion animals or cultural icons, such as the koala, are likely to generate high levels of empathy. By bringing empathy into decisions about animals, we are more likely to arrive at a conclusion with which we feel emotionally comfortable.

Broadly speaking, the application of a preference utilitarian approach to transgenic issues delivers four types of outcomes:

— uses that are generally acceptable, often because their extrinsic risks (health, animal welfare, environmental, economic or social) and intrinsic objections are perceived as negligible, and the benefits are clearly attainable;

— uses that are only acceptable when the extrinsic benefits are sufficiently great as well as demonstrably achievable, but where some perceived extrinsic risks and intrinsic objections must be weighed carefully against those benefits;

— uses that are unacceptable due to high extrinsic risks; and

— uses that are intrinsically unacceptable, irrespective of the benefits that may arise from them, or an absence of extrinsic risks.

Intrinsic objections do not relate to consequences or effects but to the action itself and are underpinned by a range of social and personal beliefs, including:

— *Religious teachings about the place of humans in nature and in relation to a creation deity*. Most religions have commentary about the place of humans relative to other life forms, whether it be one of dominion over animals, an *ethos* of stewardship, or explicit instruction about non-association with certain animals. Transgenesis may challenge some teachings and is sometimes seen to place humans in the position of "playing God" by creating new life forms or tinkering with the blueprints of life forms.

— *Personal beliefs about respect and consideration owed to other life forms*. These beliefs are often explained in terms of perceived sentience of other life forms, their aesthetic appeal, ecological value, or wonderment at their biological complexity. Transgenesis is seen to constitute a lack of respect for the natural dignity that an animal may warrant.

— *Concepts of the "natural" or acceptable in Nature.* This often may be expressed in terms of a religious belief, or an understanding of evolutionary process and/or ecological dependency. Transgenesis may be perceived by some as involving the creation of life forms by means not found in Nature.

— *Beliefs about species barriers*. Beliefs in barriers between species, in particular between human and non-human beings, are deeply ingrained and common to most cultures, irrespective of how we view humans in relation to other life forms or our personal beliefs about the consideration owed to other life forms. The "otherness" of other forms of life is an awareness formed in early childhood. Species are commonly defined in terms of breeding barriers, and transgenesis is seen to breach those barriers.

— *Economic purpose versus natural purpose*. The commonly held belief that patenting of transgenic life forms is wrong seems at odds with the general acceptance of ownership involving non-transgenic life forms (e.g. livestock, companion animals). The apparent contradiction may reflect a more subtle view of the human-animal relationship, and a belief in the existence of a "natural purpose" for animals. Ownership of non-transgenic life forms may be seen as a relationship based on stewardship or custodial responsibility, whereas the patenting of transgenic life forms is seen to subvert human obligations inferred in that traditional relationship, and implies no natural purpose for the organism other than a human-defined one.

Importance of Intrinsic Objections to Transgenesis

Intrinsic issues play an important part in the wider community's concerns about genetic modification, and transgenic animals in particular. Surveys (3–6) in Greater Europe, the UK, New Zealand and the USA show that around 70% of respondents regard genetic engineering as "morally wrong". However, opposition based on specific scenario questions tends to be much lower, a point that may be interpreted as evidence of general confusion about issues

in genetic engineering. We suggest an alternative interpretation is that public attitudes are based on quite subtle case-by-case calculations of cost, benefit and ethical considerations, but that they are underpinned by an understandable caution about a technology where the potential benefits are yet to be widely experienced.

Views of the acceptability of transgenesis may well be culturally dependent. In New Zealand, for example, Maori respondents have raised concerns about cannibalism if they eat an animal containing human DNA, and bestiality if a human has DNA or organs derived from non-human beings (6). A greater acceptance of transgenic animals for medical uses than for food production (7) may be restricted to Western societies where cancer and organ failure are more likely to be a cause of death than is a lack of food.

Proponents of transgenesis may not take intrinsic objections with a great deal of seriousness and may not attempt to address them with the same rigour that they apply to addressing welfare, health or environmental risks. They may assume that any opposition that does not focus on extrinsic risk can be explained as fear of new technology and can be expected to disappear as people become accustomed to it (8). To some extent this last point may be true. The first human organ transplants were greeted with opposition that has since been dissipated as their value has been repeatedly demonstrated. Nevertheless, it is quite clear that some intrinsic objections are strongly held and cannot be remedied solely by education, by addressing welfare, health or environmental concerns, by appeals to logic, by demonstrating inconsistency of reasoning or by promises of benefits that genetic engineering may bring at some time in the future.

Decision-making in the Face of New Technology

The regulation of transgenic animal use is often based on the proposition that most applications are indistinguishable from traditional breeding methods, and since the traditional uses are ethically acceptable, so, too, is transgenic animal use.

Transgenic animal production can be both qualitatively and quantitatively different from animals bred by traditional methods. Transgenic animals can be made to display novel characteristics that cannot be achieved by traditional breeding and treatment methods, and so can be used for entirely new purposes, and for a wider range of existing purposes. Transgenesis also enables a more rapid expansion of uses to which animals can be put than is possible with conventional breeding methods, and that rate of change can easily outstrip public policy, government regulation and social acceptance of the technology involved.

The ethical boundaries between transgenic and non-transgenic methods may be difficult to define, but they are genuine. Bruce & Bruce (9) discussed the ethical trap of gradualism: we should not assume that we condone all uses of animals, or any use for which there is some human benefit, simply because we condone some uses. For example, the general ethical acceptance of the use of pigs for meat, and more recently for heart valve transplants, should not be seen to be ethically indistinguishable from their use in xenotransplantation. Our acceptance of a current practice does not imply or require us to accept a similar practice, but it may force us to reassess our acceptance of the current practice. So an outcome of deeper consideration of the ethics of genetically modified animals may be a reassessment of our ethical acceptance of non-transgenic animal practices.

Transgenic animals are certainly different from non-transgenic animals in that the level of uncertainty surrounding both costs and benefits is so much higher for genetically modified animals. Estimating the probability of achieving an intended outcome is harder, while producing extreme and unintended outcomes is easier.

This uncertainty is due principally to genetic engineering being a leading-edge technology that we understand imperfectly, and our attempts to manipulate genes toward particular outcomes are, to a large extent, experimental. Secondly, the technology has evolved more rapidly than our capacity to regulate it, and it has been driven, in part, by commercial interests. Both reasons may have resulted in some lack of access to information that would allow risks and benefits to be evaluated more accurately.

The Banner Report: an Application of a Utilitarian Ethical Approach

In 1995, the UK Ministry of Agriculture Fisheries and Food delivered a seminal report about the ethical implications of emerging technologies for the breeding of farm animals. Commonly referred to as the Banner report (8), it articulated three principles for animal use (p. 8):

— "Harm of a certain degree and kind ought under no circumstances to be inflicted on an animal".

— "Any harm to an animal, even if not absolutely impermissible, nonetheless requires justification and must be outweighed by the good which is realistically sought".

— "Any harm which is justified by the second principle ought, however, to be minimised as far as is reasonably possible".

The Banner report regarded intrinsic objections seriously and did not take the view that because those opinions often were expressed with some degree of emotion, they were irrational or invalid. It also took the view that an assessment of ethical matters simply on the basis of a cost–benefit analysis, without acknowledgment of intrinsic objections relating to certain actions, was not acceptable to the majority of the community, nor was it a good basis for public policy. Cost–benefit analysis could not be the sole test of ethical acceptability. Transgenesis was not intrinsically objectionable, but some of its applications could be. The Banner report summarised the range of intrinsic ethical objections as arising from a belief that some uses of animals involved:

. . . an essentially improper attitude towards them, expressing, in effect, the view that animals are no more than the raw materials for our scientific projects or agricultural endeavours . . . [Such an attitude] . . . fails to take account of the fact that the natural world in general, and animals in particular, are worthy of our respect as possessing an integrity or good of their own, which we ought not simply to disregard.

Using these principles, the Banner report divided the use of emerging technologies on animals into three categories:

— Uses that were generally acceptable within the requirement for minimisation of harm, including techniques such as embryo transfer that could be used in the development of transgenic animals.

— Uses that were justified only in particular circumstances where substantial good was expected, including the use of animals for xenotransplantation.

— Uses that were identified as intrinsically objectionable, including genetic modification of a type that may constitute an attack on the animal's essential nature.

The concept of an essential nature is not new, being similar to the Aristotelian concept of *telos*, the end state or goal of an animal, and the basis of arguments put forward by some modern-day ethicists. Critics of "essential nature" argue that the concept is of little use as the basis for an ethical system, because it is not practically possible to draw up a set of rules that objectively defines the essential nature of a species.

Rather than trying to provide rules about what constitutes an attack on essential nature, the Banner report (pp. 14–15) cited three hypothetical examples to illustrate their view of what was, and was not, acceptable.

— *Genetic modification that increases the protein content of cows milk.* The Banner report took the view that this kind of modification ". . . seeks to enhance a particularly desirable trait, . . . does not affect the animal's defining characteristic, nor threaten the achievement of its natural ends or good . . . but respects its essential nature and well-being".

— *Genetic modification that causes poultry breeding stock to produce only female chicks.* The Banner report took the view that this kind of modification ". . . would not deprive the chicken of the freedom to express normal behaviours . . ." although it acknowledged that it is more radical in the sense that the end result may not be argued to be a straight-forward enhancement of a particularly desirable existing trait.

— *Genetic modification that decreases the sentience and responsiveness of pigs, thus making them more sedentary and quicker to put on muscle mass*. The Banner report took the view that this kind of modification, irrespective of any benefit to profit margins, is ethically objectionable because the human ends and purposes override the ends and purposes that are natural to the animal, and it is an attack on the animal's essential nature.

Extrinsic Costs in Ethical Decision-making

Our emphasis on intrinsic factors in decisions about the use of transgenesis is not meant to imply that the evaluation of extrinsic factors is always simple or free from difficult ethical equations. To the contrary, cost–benefit analyses of extrinsic factors can be particularly difficult, especially where obvious short-term economic gains must be balanced against uncertain long-term environmental, health and welfare risks. However, health, welfare and environmental factors are more likely to be explicitly taken into account in the regulation of transgenesis than are intrinsic objections. Some of the most difficult ethical equations involving extrinsic factors are:

— *Transgenesis where disease, disability or environmental degradation is inevitable.* The often-cited example is that of oncomice, mice genetically modified to inevitably develop cancers. A more unusual example is the proposal to inoculate Australian cattle with transgenic rumen bacteria that would have made livestock immune to the poisonous effects of fluoroacetate, a natural compound that protects certain native Australian plant species from grazing. The genetic modification would have enabled livestock grazing to be expanded and intensified

in areas of native vegetation that were previously protected by its naturally high levels of fluoroacetate, with probable effects on the conservation of native fauna and flora. The high risk of spread of the genetically modified bacteria to feral ruminant populations, a major conservation threat in Australia, was also of concern.

— *Transgenic lines leading to much greater wastage of animals.* Some sources of wastage include low success rates of current techniques to create novel lines of transgenic animals (often cited at 2% or less), and inherent phenotypic instability that requires culling of variant animals in order to keep the transgenic line pure. A third source may be the variable demand for a wide range of animal lines, placing pressure on businesses that supply animals to manage their stock animals in ways that increase economic efficiencies but require more culling.

— *Transgenesis that allows for reduction in conditions of care for animals.* Transgenesis has the potential to reduce welfare problems in animal production, in particular reducing disease susceptibility. The production of a transgenic chicken that is less aggressive might reduce the need for practices such as de-beaking. It could be argued, using the example from the Banner report, that the transgenic pig modified to have decreased sentience and responsiveness is less likely to experience suffering from its condition, and hence that the genetic modification produces a net welfare benefit for the individual. Taken one step further, the view could be taken that such a pig would be equally content in a smaller enclosure than those given to non-transgenic pigs.

— *Transgenesis where benefits are not primarily for health, welfare or environment.* The preoccupations of modern Western society makes it likely that economic efficiencies, human vanity (such as baldness cures or pets with novel characteristics), scientific curiosity and public acclaim may become the impetus for the development of some uses of transgenic animals.

Toward a Framework for Making Public Policy about Transgenic Animal Use

A number of writers have proposed that, just as an ethical decision based purely on emotion is not able to be morally defended, so any ethical stance based exclusively on logic and reason is likely to fail the test of application to real-life situations (10). Others proposed that decisions about the acceptability of genetic engineering should be made solely on "a rational and considered basis"(11) — an approach that would appear to take account only of extrinsic costs and benefits.

We argue that public policy on transgenesis should reflect some widely accepted community beliefs about animals and their relationship with humans, because those beliefs underpin community views of what is ethical with regard to transgenesis. Good public policy has been described as solving problems and contributing to justice, citizenship and democracy (12). Good policymaking also "seeks to establish the ethical, moral and legal base for policy" (13). It is doubtful that policy on transgenesis that is a very long distance from widely accepted community beliefs about what is ethically acceptable would be seen to contribute to democracy, justice, or a sense of citizenship, or last long with governments that are sensitive to public pressure.

This is not to say that public policy about the use of transgenic animals should be based solely or even heavily on intrinsic beliefs. Welfare, health, environmental, social and economic benefits must all be possible under policies on the use of transgenic animals. Good policies must provide leadership and enact some vision of what outcome is sought, rather than just reflect the status quo or popular views. Policies that lead an issue are forward-looking (with some future goal), outward looking (to the wider or world context), and evidence-based (13) — all features that might be expected to deliver a "rational and considered" policy.

Proponents of transgenesis may assume that, risk factors being no barrier, the market should be the primary determinant of the purposes for which new transgenic animals should be developed. In this view, only the methods of transgenesis and the extrinsic risks of their outcomes should be regulated. However, a public policy that takes into account widely held intrinsic views may also restrict the uses for which transgenic animals can be created.

Given that intrinsic beliefs about animals are increasingly diverse and frequently based on personal experience rather than being narrowly and culturally constrained, identifying beliefs that could usefully and consistently contribute to public policy about animal transgenesis is more difficult. The spectrum of views on the use of transgenic animals is broad also, because potential applications of animal transgenesis are wide, but its realised benefit are, as yet, small; hence, there are few demonstrable achievements around which to frame a consensus.

As in any public policy development process, the spectrum of views must be sought, understood, categorised, interpreted, weighed and addressed or discarded in the search for an acceptable position. A key factor in achieving a balance between the overall vision of the policy (the position it takes and where it

seeks to lead) and the public views is to have a well-informed, vigorous, open and even-handed public debate. However, we should not fall into the trap of believing that intrinsic objections are solely a consequence of ignorance that can be dispelled by creating a better-informed public. Education is important in the process of policy development — it sorts the immovable objections from those that are movable, it allows people to be more comfortable with new government policies, and it contributes greatly to a sense of citizenship. But it must be open and even-handed public debate, not propaganda by proponents of only one viewpoint.

In an area where public policy is hard pressed to keep up with the rapid pace of technological change, public interests might be best served by developing dynamic processes for regulating the use of transgenic animals that have the capacity to reflect shifting public attitudes. A system such as the institutional Animal Ethics Committees (AECs) used in Australia and elsewhere to regulate the use of animals in research and teaching is one such mechanism (14). By including membership from researchers, veterinary scientists, welfare groups and the general public, each AEC brings a broader spectrum of community views about the use of animals to bear on a practical case-by-case use of animals. The AECs are guided in their assessment of individual projects not primarily by legislation (the revision of which is both expensive and rarely done on a time-scale that would keep pace with rapid technological change) but by a Code of Practice (15) that can be revised with greater ease.

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