

Leonardo's Choice

Carol Gigliotti
Editor

Leonardo's Choice

Genetic Technologies and Animals

 Springer

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Preface

Defending animals' rights is often a contentious activity even among friends and colleagues. This volume emerged from just such a situation and it is to the credit of my good friend and colleague, Victoria Vesna of the University of California LA (UCLA), that it first took shape. Having read my essay "Leonardo's Choice: the ethics of artists working with genetic technologies" and witnessing negative reactions to the idea of critiquing work from an "animal standpoint," she invited me to guest edit a special issue on this topic for the journal *AI & Society*. Out of this issue grew the impetus for the present volume. I wish to thank her for her foresight and support, as well as the Editor-in-Chief of the journal *AI & Society*, Karamjit S. Gill. I owe everyone with whom I have worked at Springer, both for the journal issue and the book, a debt of gratitude: Beverly Ford, Executive Editor of Computer Science, Fritz Schmhul, now in Life Sciences, and my editors in Bioethics/ Philosophy, Jolanda Voogd and Marion Wagenaar. At all times, their professionalism and patience has been a gift.

An enormous debt of gratitude is owed to each and every author of the essays included here. Their fearlessness in speaking out has been a constant source of inspiration and their eloquence a joy to read. Without their generous participation the publication of this book could not have taken place. Each has contributed enormously to this book and to the growing area of animal studies in positive ways affecting our changing relationship with animals and the entire non-human world.

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This book is dedicated to the memories of Nik Williams, Laurie Long, Dan O'Connor and, of course, Radicchio.

Vancouver, BC, Canada

Carol Gigliotti

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Introduction

Carol Gigliotti

Abstract *Leonardo's Choice: Genetic Technologies and Animals* is an edited interdisciplinary collection of 12 essays and 1 dialogue focusing on the use of animals in biotechnology and the profoundly disastrous effects of that use for all inhabitants of this planet. As editor of this collection, my essay “Leonardo’s Choice: The Ethics of Artists Working with Genetic Technologies” grew out of an increasing concern with the risks of genetic technologies for animals in scientific research and the genre of art practice involving genetic technologies and the non-human. While some of the work in this art genre aims to question the corporate uses of genetic technologies, much of the work is based on an acceptance of the inevitability of these technologies. I wanted to investigate if using the methodologies of a science still positing human beings as the centre and rationale of all endeavours, and animals as mere resources, would serve only to reinforce that anthropocentric view in the arts and a corresponding commitment to this view in broad cultural perceptions. I began with the belief that whether the object of genetic modification or transference is plant, animal, or tissue, one needs to question, confront and act on the ethical impact that instance of commodification and colonization will have on the future of a naturally occurring biodiversity and on the individual lives of non-humans involved.

Keywords Animals · Genetic technologies · Ethics · Art · Animal studies

The title of this book, *Leonardo's Choice*, and the title of the essay from which it came, refers to Leonardo’s view of himself as both a scientist and an artist. Like Leonardo, who had compassion for animals and yet used them for his art, contemporary scientists and artists are faced with a choice: to view their creative human drive as limitless or to acknowledge real and possible consequences of their use of living beings in these “creative” pursuits. The latter choice would entail a new and more responsible understanding and practice of the organic creativity of which all beings, including humans, are a part.

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This collection focuses on the profound effect, for both humans and non-humans, of using animals in genetic technologies. Unlike the majority of discussions on biotechnology, whether endorsing or critical, this volume, as a whole, views seriously the disastrous impact of these technologies on animals themselves. Amidst the wealth of human intelligence and imagination invested in the development of technologies, the natural world and non-human beings have been regulated to proprietary roles, even though our technological innovations could not exist without them. Our long-standing pre-occupation with technological outlooks and technological solutions have obscured the reality and agency of the more-than-human world, or what is left of it. If we have appeared, up to now, sanguine about the erosion of our “real” home while we have been busy in our “virtual” one, the results of this disconnection from our physical legacies are beginning to unravel that complacency.

The consensus among biologists is that we now are moving towards the sixth great species extinction, the first to be caused largely by the activities of a single species—us (Levin & Leakey, 1995). The effects of global climate change, one of this extinction’s major causes (Mayhew et al., 2008), are now grasped both through media and first-hand knowledge. In addition, these effects have encouraged a mounting awareness of the negative consequences of our long history of a self-serving anthropocentrism, enacted, mediated and created through technological means. Coinciding, but not coincidental, with this sporadic and often rationalized and sublimated comprehension is a growing concern for biotechnologies’ impacts on the food we eat, our health care and our environment, both natural and built. These worries have encouraged the recent growth of bioethics committees and institutes ranging from those who seem to serve either as apologists for an inevitably biotechnological future or those few who, against great odds, question this same inevitability. For some, the increasingly invasive uses of animals in genetic technologies have supplied a warning sign to back up and survey our handiwork. What kind of future would include a legless pig or a featherless chicken, we may ask? And to our dismay, we learn both already exist in varying forms.

In 2000, the image of a green fluorescent rabbit appeared in various media across the globe. Newspapers, magazines, television and the Web told the story of artist Eduardo Kac who had “commissioned” the transgenic process of taking green fluorescent protein from a little Pacific jelly fish, *Aequorea victoria*, and inserting it into the zygote of a rabbit, an art piece he called “GFP Bunny”. Many of the reports mentioned the fact that the documented process of making transgenic animals using mice had been going on since 1981, and since 1985 using other animals, such as pigs, sheep, rabbits and fish. The public reaction to this well-publicized example, however, was overwhelmingly one of shock and discomfort. The idea of an artist taking control of a transgenic process was fertile ground for a sudden public realization: biotechnological activity involving animals was not just the stuff of science fiction, but was actively being accomplished in such a way that a non-scientist could direct the process. The viability of the genetic modification of animals noisily entered the public consciousness.

The Context of Animal Rights

If this example was a shock to the general public, it was not surprising to a number of those involved in animal rights and animal advocacy. One of the major intellectual leaders of the animal rights movement, philosopher Tom Regan (2001) recognized the significance of these developments when he said,

Few areas of applied philosophy have witnessed more dramatic growth in the recent past than has bioethics, moreover, given the pace of advances in the life sciences, from developments in preventive medicine to the cloning of sheep and mice, few areas of ethical concern are likely to grow more dramatically in the foreseeable future. . . . Whatever the future holds, one thing is certain: other-than-human animals will be used in the name of advancing scientific knowledge, both basic and applied. What is less certain is whether in doing so, those who use them will act wisely and well. (p. 1)

Discussions and perspectives about the morality of using animals for scientific purposes are informed by a long history of humankind's attitudes towards the other animals, one divergent in its origins and in its normative views. It can be argued that if ancient theories based on the notion of harmony both among humans and between humans and non-humans had prevailed, our wholesale acceptance of the inferior status of animals, and thus our assumptions that they exist for our use, would be an atypical perspective.

Italian philosopher Paola Cavalieri forcefully argues just this point by re-examining three critical moments in the history of our dominion over animals. For Cavalieri (2006), the first moment is the

. . . struggle within the Classical Greek world between the idea of an original bond among all conscious beings and a contrasting global plan of rationalization of human and nonhuman exploitation. (p. 54)

Cavalieri (2006) and other authors¹ view this struggle, based as it was on the construction of initial political and economic justifications of protecting the order of the *polis*, as an important turning point in the triumph of the exploitation of animals. Commitments to both kinship with and justice for animals in the early Greek thought of Pythagoras were distorted as a consequence of this turning point. While critics have overlooked or trivialized Pythagoras' vegetarianism and his teaching of such, this way of life was due to his integrated worldview of the notion of harmony. He saw friendship to both humans and non-humans as a crucial contributing virtue in this worldview.

An alternative view of the human–animal relationship existed in the diverse history of ethical vegetarianism dating at least as far back as Pythagoras (c. 580 BCE–500 BCE) in the West and in Hinduism (c. 6500 BCE), Jainism (c. 7 BCE), Taoism (c. 6 BCE) and Buddhism (c. 6 BCE) in the East (Lucas, 2005). Thinkers in these religious practices spoke out against two of the most visible forms of animal suffering during these ancient times—meat eating and religious sacrifice. Harmony with nature and respect and compassion for *all* life forms were tenets of these geographically separated but spiritually connected movements. Recognizing

the importance of these religious movements to the development of the major ethical and philosophical ideas shaping human thought can only give one pause in imagining a present quite different from the global market and technological culture we now inhabit, based as it is on the deaths of approximately 55 billion land animals alone killed annually for food worldwide.²

The second pivotal moment Cavalieri and others have described in the path to our present-day uses of animals is the scientific revolution of the seventeenth century led by Descartes and his followers. In his search for a stable foundation on which to base the “truth” of scientific discoveries, Descartes insisted one could rely only on one’s ability to doubt and therefore think. The human body—a mere machine—was a vessel in which the human mind, the self, was enclosed. Only humans possessed this self that Descartes considered to be the soul. Animals, uttering horribly wrenching cries of pain and fear as they were being eviscerated while alive, had no soul, so were not really experiencing pain. Experimentation on them now was not only possible, but also considered to be necessary as a component of methods for doing a new and modern science based on rational and testable evidence. While this view and use of animals was contested by contemporaries of Descartes as well as those who wrote during the Enlightenment and beyond,³ Descartes’ insistence on the necessity of these methods for “true” knowledge opened the door to the wide use of animal experimentation. The number of animals used globally today in various experiments is approximately 180 million each year, an underestimation due to the lack of reporting in many countries and the non-reporting of birds, rats and mice in the United States.⁴

Cavalieri sees the last few decades’ rapid process of industrialization and mechanization of farming practices as the third moment in the move to control and dominate other animals. Developing at an alarming rate, however, is an even more persistent and overwhelming trajectory that may, in fact, enforce irreparably the status of animals as inferior and existing solely for our use. I see this as a fourth and, perhaps, catastrophic moment in the centuries-long shift from our understanding of our communion and solidarity with the non-human, ensouled world to a world in which we see ourselves as the creators of all life.

This moment is our moment: the advent and growth of biotechnologies. A great deal of discourse and practice about the creative possibilities of these technologies is influenced by commitments to capital-fueled ideas of progress. Unfortunately, even the push towards more “sustainable” and presumably “nature friendly” ideas about creativity has produced examples such as salmon sperm, seen as bio-waste from the fishing industry, being used to make nanotechnological “green” LED displays.⁵ While this may be touted as a creative collaboration with nature, it is in reality pure exploitation of our fellow beings.

The long road from the once flourishing acceptance of animals as allied beings in the sixth century BC with Pythagoras, into the fifth and fourth centuries and even the third century BC with thinkers such as Porphyry, has degraded into the currently growing wholesale acceptance of technologies in which animals are seen as mere objects of use. These changes are the result of shifts to more expedient worldviews

at key historical moments in reaction to changing political and economic realities and choices, not unlike our realities and choices today.

Conterminous with today's programs of globalization and biopolitics with their mass negative effects on humans⁶ and, consequently even more negative effects on animals, there has been a slow and steady building of arguments and support for possibilities, as Cavaleiri concludes "... to defend the idea that animals' lives have value. . . and to consider it wrong to kill them" (p. 66). The upheavals involved in the success of these arguments from philosophers such as Regan, Cavalieri and Best, among others, have been felt in the growth of animal rights organizations across the world, as well as protests and direct action against uses of animals in animal experimentation, factory farming, fur farming, hunting and entertainment, among other uses. Voices in the arts, humanities and sciences have begun making overtly visible the importance of our relationship with non-human others in our own construction of a human identity. But, as Carey Wolfe (2003a) points out, "... the US public has long since gotten the point that is just beginning to dawn on our critical practice" (p. 1), at least in terms of more inclusive attitudes towards animal cognition and consciousness. It is also true and needs to be articulated clearly that the current goals of Western science and technology, bound up as they are with entrenched ideas of animals and nature existing solely for our use, are antithetical to these challenges and are still driving the development of "transformative" biotechnologies.

The Context of Genetic Technologies

This collection's central questions revolve around how Western ideas and practices of creative freedom are disassociated from the impacts they have on the non-human world. This disassociation has contributed to shifting an organic understanding of nature to a mechanistic model in which the image of the non-human world is one of an (mere) inert, soulless machine⁷ and in which the agency of animals is obscured. Contemporary ramifications of this shift include an emerging emphasis on the technological *replacement* of the naturally occurring world, a *technodevolution* that devalues a naturally occurring biodiverse earth and the uniquely occurring characteristics of its multi-species inhabitants. The reductive nature of much technological thought devolves and flattens the creative organic biodiversity of the natural world.

The term "biotechnology" was coined in 1919 by the Hungarian engineer Karl Ereky, and supporters of its growth often cite the use of yeast to make bread and beer, as well as dog breeding, as earlier examples of the long history of what is now biotechnology (Bud, 1993). The advent of modern biotechnology in the 1970s, however, is commonly considered to be the discovery of the first restriction enzyme, an enzyme that cuts specific sequences of double-stranded DNA, leading to the development of recombinant DNA technology (Nobel Prize Foundation, 1978). The first practical use of this work was the manipulation of *Escherichia coli* bacteria to produce human insulin for diabetics (Villa-Komaroff et al., 1978).

Modern biotechnologies, including genetic transfer and artificial cloning, based on similar discoveries throughout the end of the twentieth century and into the

twenty-first, contrary to the insistence of some genetic technology proponents, are radically different from traditional plant and animal breeding. Unlike traditional breeding, genetic technology methods disrupt the sequence of the genetic code of the host, disturbing the functioning of neighbouring genes. Even more important, however, is the ability in genetic engineering to transfer genes across species barriers. The practical outcomes of this are unanticipated side-effects for the recipient organism as well as special risks that come with the use of viral genes and vectors in genetic engineering. The instability of this genetic material and its propensity to recombine with infecting viruses may give rise to new viruses that may become potentially dangerous pathogens for plants, animals and human beings (Antoniou et al., 1997).

The scientific community is still divided about the effects of genetically modified “products”, of both animals and plants, even though the overarching received view is that genetic technologies specifically, and biotechnologies in general, are supported by the majority of the scientific community. A study by the Cornell University science faculty, however, found that while almost half of the scientists polled had reservations and criticism about genetically modified food and crops, these scientists were less comfortable expressing their views with colleagues than those scientists with pro-genetically modified food views (Kuehn, 2004). In fact, there have been a number of documented cases where university scientists whose research has turned up negative consequences of transgenic technologies have been stifled at every turn by both large biotech companies and their own university administration afraid of losing funding from those same companies. (Charman, 2001; Dowie, 2004). Novelist Michael Crichton’s take on the entwinement of genetic research and commerce, to which Carol Freeman refers in her essay in this volume, is a pithy comment on the state of the art: “Crichton calls the commercialization of molecular biology ‘the most stunning ethical event in the history of science’” (as cited in Freeman, 2009). Judith Roof (Roof, 2007) clarifies a probable determinant for the ease with which genetic technologies and corporate goals have merged when she calls DNA “the perfect commodity” (p. 198). In its tiny, neat package of information of instruction and operation, so easily transportable, and ability to last, she adds, it is “the perfect version of an imaginary entity that in itself embodies a shift in our ideas of history, identity, commodities, and commodity systems” (p. 198).

One of the most influential books describing the assumptions (other than monetary gain) driving the concepts in scientific enquiry, particularly those involving the gene, are Evelyn Fox Keller’s (Keller, 1995, 2000) *Refiguring Life* and *The Century of the Gene*. Keller’s purpose in both books is to demolish the widely held but simplistic concept of the gene as the smallest unit constituting a “program” for making an organism. She emphasizes how assumed gender metaphors in everyday language, combined with computer terminology, influenced by military, cybernetic and reductionism assumptions, have played a powerful role in the development of genetic sciences. Many scientists in molecular biology, as Keller explains in *The Century of the Gene*, have now realized this as an unhelpful causal model for evolutionary complexity. Consequently, the field of evolutionary developmental biology, formed largely in the 1990s, is a synthesis of findings from molecular developmental

biology and evolutionary biology. “Evo devo”, as it is sometimes called, considers the diversity of the organismal form in an evolutionary context and emphasizes the *linked* process and context of evolutionary development for animals and humans (Carroll, 2005).

Notwithstanding influences of this growing field on biological thought, the incorporation of information theory and cybernetics, both building blocks of contemporary informatic thought and practice, still holds sway in molecular biology and genetics. This combination of informatics and genetic technologies has encouraged a new concept of biological materiality, one particularly suited to transportable commodification. “Despite this newfound materiality made possible via informatics, there is also a strong emphasis on the valuation of genes or DNA. . . . A database, can exist, in effect, without computers of any kind” (Thacker, 2005, p. 101).

The BAC, or “bacterial artificial chromosome”, is a kind of wet biological “library”. A free-floating circular loop of DNA called a “plasmid” found in bacteria such as *E. coli* and spliced with a gene sequence from a human or animal is used to investigate samples of any desired gene. A section heading, in an essay written by three researchers at Yale and Mt. Sinai Schools of Medicine, is entitled “Farm animals: an unexploited gold mine for biotech”. This article is found in Oxford University’s *Nucleic Acids Research Journal* online and includes a short paragraph on the “Ethical reservations of farm animal genomic study”. It exudes enthusiasm, however, for utilizing animals for many uses:

Farm animal genomic studies continue to attract audiences excited by the multitude of applications. The meat industry can now use cow and chicken genomic data to confirm the quality of meat products. . . . In the healthcare arena, farm animal genomic work will aid in enterprises such as xenotransplantation (the transfer of animal tissues or organs into humans). (Fadiel et al., 2005)

The rhetoric found in this quote is instructive in understanding crucial aspects in what Thacker calls “informatic essentialism” in the context of biotechnologies. Instead of the dematerialization of the body written of so eloquently in much post-humanist discourse, genetic technologies in combination with database technologies are used to redefine biological materiality (Thacker, 2003, p. 89). Farm animals, already redefined as such by centuries of use in human food and labour, are now approached by the life sciences and medical practices as data warehouses of information. As information, animals are now able to be reconfigured, recoded and most importantly redesigned for, as the above quote makes clear, commercial enterprises: food, health, military, even “eco-friendly” or “sustainable” undertakings.

While researchers in comparative ethology, the study of animals in the field, are contributing to comprehension of the cognitive and emotional lives of other beings, much of the work in genetic technologies is reinforcing an understanding of animals as suited to act as a material language, a symbolic technique, without concern for their intrinsic value as beings with whom we share this planet. Animals have been conscripted into these technologies to further an agenda of controlling the creation of all life through the manipulation of various manifestations of code. *In today’s biotechnologies, animals have become code.*

The history of animals being used in genetic technologies begins in 1980, with the creation of the first “transgenic animal, a mouse—in such a way that the gene would be expressed in the mouse and in its future offspring” (Ihlman, 1996). At the time of this writing, the most recent transgenic “advance” was reported in a *ScienceDaily* headline: “Scientists have developed the first genetically altered monkey model that replicates some symptoms observed in patients with Huntington’s disease” (NIH/National Center for Research Resources, 2008).

In July 2005, the results of a committee made up of invited stem cell scientists, primatologists, philosophers and lawyers were published in *Science Magazine*. The group was brought together at John Hopkins University to deliberate on the potential effects of grafting human stem cells into the brains of non-human primates, the first instance of which was in 2001. Organized two years after the initial experiment, the 22-member panel took two more years to agree “. . .to disagree about whether non-human primates should be used for invasive biomedical procedures at all, and to focus instead on whether experiments with stem cells and the brain posed any new, unique ethical dilemmas.” Mark Greene, Ph.D., and a member of the panel, said,

Many of us expected that, once we’d pooled our expertise, we’d be able to say why human cells would not produce significant changes in non-human brains. But the cell biologists and neurologists couldn’t specify limits on what implanted human cells might do, and the primatologists explained that gaps in our knowledge of normal non-human primate abilities make it difficult to detect changes. And there’s no philosophical consensus on the moral significance of changes in abilities if we could detect them. (Greene, 2005)

The organizers of the panel may be commended for initiating this discussion. The fact, however, that 22 so-called experts could not specify what kind of effect implanting human cells might have on non-human primates does not speak particularly well for arguments for the blanket acceptance of this or similar techniques of genetic technologies. This group, instead, concluded,

. . .cognitive and emotional changes are least likely to occur when such work is conducted on healthy adult members of species *distantly* related to humans, such as macaques, rather than early in the brain development of our closest biological relatives, the chimpanzees and other great apes. [p. 386, my emphasis]

Sidestepping the larger and unresolved “old” issue of using animals in research for any purpose, the committee produced in its quest for “new ethical dilemmas” a cowardly, but ironic and revealing tautology. As a group they decided that in lieu of any real knowledge of whether grafting human stem cells into the brains of “higher” primates would cause them to become more like humans than they already obviously are, researchers should graft those cells into the brains of “lesser” monkeys, which again, in lieu of any real knowledge, may or may not have the effect of making them more like humans. Philosopher Mary Midgley’s famous and succinct quote about the ethics and efficacy of animal experimentation would have been helpful if only the committee had been open to reasoning along with her about animals in general, “. . .if they are sufficiently like us to be really comparable, they may be too like us to be used freely as experimental subjects” (Midgley, 2003, p. 147).

Tom Regan (as cited in Svoboda, 2008), speaking about the untold numbers of animals upon whose death and suffering one successful transgenic experiment is based, insists,

The animals used for these purposes are in fundamental ways like us—their behavior tells us they're like us, evolutionary theory tells us they're like us. . . . What we have with transgenic research is another incentive for reducing animals to something whose purpose for being in the world is to serve human interests. And that's fundamentally flawed (para 14).

In response to the objection that using animals in research is worth it because it saves lives, a recent report from the Medical Research Modernization Committee states the opposite case very clearly:

The value of animal experimentation has been grossly exaggerated by those with a vested economic interest in its preservation. Because animal experimentation focuses on artificially created pathology, involves confounding variables, and is undermined by differences in human and nonhuman anatomy, physiology, and pathology, it is an inherently unsound method to investigate human disease processes. The billions of dollars invested annually in animal research would be put to much more efficient, effective, and humane use if redirected to clinical and epidemiological research and public health programs. (Anderegg et al., 2002, p. 18)

Leonardo's Choices

Leonardo's Choice: Genetic Technologies and Animals is an edited interdisciplinary collection of 12 essays and 1 dialogue focusing on the use of animals in biotechnology and the profoundly disastrous effects of this use for both animals and us. As editor of this collection, my essay "Leonardo's Choice: The Ethics of Artists Working with Genetic Technologies" grew out of an increasing concern, not only about the risks of genetic technologies in general, but also with a growing genre of art practice involving genetic technologies and the non-human. While some of the work in this art genre aims to question the corporate uses of genetic technologies, I wanted to investigate if using the methodologies of a science that still posits human beings as the centre and rationale of all endeavour, and nature and the non-human as mere resources, would only serve to reinforce that anthropocentric view in the arts and corresponding cultural arenas. I began with the belief that whether the object of genetic modification or transference is plant, animal or tissue, one needs to question and confront the ethical impact that instance of commodification and colonization will have on the future of a naturally occurring biodiversity and on the individual lives of non-humans involved.

In this way, the collection makes a useful contribution to a growing discussion in both academic and public forums concerning ethics and animals. Seven of the essays were published in 2006 with an introduction and photos of animals in laboratory settings in a special issue of the Springer journal *AI and Society*.⁸ As guest editor, I invited contributors from the disciplines of philosophy, cultural, art and literary theory and history and theory of science, as well as environmental studies, to respond to the topics in my essay. The authors replied with unique perspectives

on the broad and multiple layers of meanings and values called into question by these themes. The volume at hand continues to be structured and integrated around the central theme of the use of animals in biotechnologies, but adds perspectives from law, landscape architecture, history, geography and cultural studies. Included authors span three continents and four countries. Since the publication of the journal issue, the growth of biotech and genetic technologies has been formidable, but the questions and issues forthcoming from the use of animals in these areas have only grown more urgent.

The included essays contribute significantly to a growing scholarship surrounding “the question of the animal” as well as counter discussions hoping to disqualify the general way that rather abstract phrase is posed, vapourizing the actual specificity of animal’s lives. Emanating from philosophical, cultural and activist discourses, this question is currently being debated in post-humanist theoretical circles as well as post-colonial ones. While a number of authors refer to, and sometimes add to, ethical and ontological views towards animals in analytic philosophy, others concentrate on perspectives and methodologies of the Continental tradition. It is hoped the collection will also contribute a critical animal studies perspective⁹ to the flourishing area of human–animal studies in the humanities and the widespread discussion of culture, technology and nature. The volume’s authors speak to an audience eager for more sophisticated investigations of the complex relationships between humans and animals and what these relationships might offer to disciplines whose most basic assumptions continue to concern the centrality of the human.

Audiences for this collection include, but are not limited to

- philosophers, lawyers, artists, activists and scholars and their students from many disciplines wishing to extend the idea of justice and intrinsic worth to the non-human;
- theorists and activists who perceive biotechnologies’ invasion of the self-organizing and generational capacities of the natural world as yet another bid for control by corporate-led globalization;
- cultural theorists and students of critical and cultural theory interested in human–animal relationships as rich areas of investigation for shifting concepts of identity and otherness.

Other edited books in this field inviting comparison include Cary Wolfe’s (2003b) *Zoontologies: The Question of the Animal*; H. Peter Steves’ (1999) *Animal Others: On Ethics, Ontology, and Animal Life*; and The Animals Studies Group’s (2006) *Killing Animals*. All three are important milestones in this nascent area of thought.

Leonardo’s Choice: Genetic Technologies and Animals differs from these collections in its focus on this most contemporary use of animals and possibly the most irreparable: biotechnology. Along with Cary Wolfe (2003a), it disregards “the humanist habit of making even the *possibility* of subjectivity conterminous with the species barrier” (p. 1). Its significance, however, lies in its urgency in critiquing the continuing blindness towards animal subjectivity involved in the use of animals in genetic technologies, as well as the control or erasure of that subjectivity through

those uses. The topic of genetic technologies, as one of the most pressing challenges to a growing concern about our relationship with the natural world, is thrown into high relief in this volume through perspectives, by and large, hoping to refute the inevitability of a biotechnological future and the rationales behind it.

This volume places animals at the centre of such discussions, refusing to dismiss the effects of these technologies on their lives and agency. This stance opens at least three related and useful paths through the jumble of conflicted assumptions and contradictions about the rationales for biotechnologically driven applications of animals. Concentrating on the central issue of the use of animals in genetic technologies elicits ethical and political viewpoints about the necessity of public involvement in any decision-making process related to biotechnologies. It also prioritizes the consideration of animals in attitudes questioning the assumed *inescapability* of these technologies. As Steven Best points out in his powerful opening essay, “Genetic science, animal exploitation and the challenge for democracy”, the unpredictable variables in biotechnological experimentation using inherently uncertain techniques combined with the instrumental use of animals cause great suffering. These unpredictabilities deeply challenge

...existing definitions of life and death, demand a rethinking of fundamental notions of ethics and moral value, and pose unique challenges for democracy. (Best, 2009)

The second useful path is the consideration of the paradoxical quality of the human–animal relationship and how it is utilized and for what purpose. A pressing question in my understanding of how to write about artists working with genetic technologies, for instance, concerned what role not only uncovering but also confronting ethical choices in this arena played in artists’ thinking and practice. The intent of many of the essays included is not only to investigate and acknowledge the complexity of the topic but also to confront and act on the ethical choices involved. Some authors use these paradoxes as places of creative investigation in which to question our use of animals as only objects for our use, while other authors see these juxtapositions as indications of the fascination with the erasure of boundaries prevalent in today’s post-humanist thinking. Still others distinguish this fascination with boundary breaching as locations where animals are made to pay for our resistance to acknowledging their intrinsic worth.

The third concept vexing these discussions is that most valued trait of the human species, creativity. How should one look at these ideas in art or science? Does curiosity, freedom of expression or invention always take precedence, or is the wider focus to see the ethical implications of these practices first and then to adjust what our goals for art or science are? Creative freedom, one of the most highly valued aspects of the human species as a social form, what Susan McHugh calls “the central cultural work of ordering species in the distinction of human species being”,¹⁰ is also a major player in maintaining dominance over non-human animals. Scientists and artists consider creative freedom an important ingredient in the development of transgenic technologies, but ironically, dominance over animals based on ideas of human centred creativity may be hard to maintain as the genetic makeup of animals is moved closer to humans.

Concern over the future, often the location where a great deal of human creativity is focused, is a common thread that runs through these essays as well as the minds of most of us in these difficult times. The essays in Part I of the collection offer differing and enlarged perspectives on the juxtapositions of animals, humans and genetic technologies and how these perspectives might shift the future towards a more ethical relationship with animals and involvement with biotechnologies. Two of the essays, those of Steven Best and Vincent Guihan, emerge from decidedly animal rights and animal liberation viewpoints, while Beth Carruthers' essay ponders an alternative stance hoping to sidestep or diffuse the clash of human and animal needs. All three cite the shared bodily being of humans and other animals as central to providing a way forward.

Philosopher Steven Best blames the current devastating impact of industrial biotechnology for animals, the natural world and shifts in how human beings visualize a future, squarely on an anthropocentric co-construction of science and technology fuelled by capitalist and corporate imperatives. He challenges the notion that a single disciplinary approach both to understanding and questioning the values, methodologies and impacts of genetic technologies will prove helpful. Insisting the future is not inevitable, but still ambiguous and open to political will and struggle, he argues instead for a "supradisciplinary" approach incorporating ethical and political values developed through an educated and participatory democracy coupled with a new sensitivity for nature.

Vincent Guihan, doctoral candidate in the Cultural Mediations program at Carleton University, builds upon Foucault's ideas of "bio-power" and "man-as-species" to reassess Darwin's influence on how we have arrived at the present moment in our relationship with animals. Guihan describes this moment as holding within it two poles of "cultural" understanding of animals: the reduction of animals (as well as humans and all of nature) into mere products for use *and* contemporary animal rights theory. He sees this latter as the "reverse discourse" of the former trend. Outlining genetic technologies' lineage in the eugenics movement of improvement of human and non-human animals, he clarifies retrograde qualities inherent in eugenic's emphasis on biology as destiny and its prioritizing of the perfection of the "human species being" ahead of all naturally occurring differences and specificities. Against this, the rights of animals not to be used, to be able to operate outside the power framework of human control, to be able to demonstrate agency, fulfill needs and meet wants are the driving goals of both Best's and Guihan's essays.

Independent scholar Beth Carruthers' essay considers the flaws in what she calls the foundational ontology of Western ethics in a search of a "shared ontology" between humans and the entire natural world. Drawing on Val Plumwood's arguments against what both she and Plumwood see as problems with rights theory, she surmises that only through accepting the unbearable intimacy of *knowing* we both feed on life and are food to it, can we begin to come to terms with our embodied relationship with the entire natural world, including animals.

Part II includes four essays and a dialogue focusing on the most visible, politically ambiguous, and debated use of animals in genetic technologies today, that of

the use of live animals, animal tissue and cells in bioart—a practice in which the medium is living matter and the works of art are produced with biotechnological tools.

My own essay, “Leonardo’s Choice: The Ethics of Artists Working with Genetic Technologies”, closely questions the notion of the radical, and hence, assumed progressive nature of biotechnological practices either for science or for the purposes of an “art form”. These questions are asked in light of growing calls by those inside and outside academe for a greater understanding of the intrinsically valuable biodiversity of nature and the impact of these art and science practices on the lives of all the animals involved. Comparing the artists’ somewhat abstract rhetoric about their work with the actuality of the life of laboratory animals, artists’ forays into the manipulation of life-forms with genetic technological practices are critiqued within the contexts of linked ethical, political, social and economic values driving the development of these technologies.

After reading my essay, cultural theorist Steve Baker suggested engaging in a dialogue which he entitled “We have always been transgenic” after a phrase of mine from the “Leonardo’s Choice” essay and what he felt might be a pivotal meeting point in our thought. Our hope in engaging and publishing this dialogue was that we might be able to explore both our common interest in contemporary artists’ engagement with questions of ethics and animal life and the significant differences in our own approaches to those questions. Our further hope is that the readers will find this helpful and stimulating for their own use.

Artist and writer Caroline Seck Langill’s essay “Negotiating the Hybrid: Art, Theory and Genetic Technologies” addresses the issue of artist’s forays into work both critical of and involved with genetic technologies from a historical perspective. Tracing contributing scientific and cultural sources from the seventeenth century on, Langill guides us into the present where contemporary artists and cultural theorists grapple with paradoxical abstractions of the freedoms of hybridity and plurality at the expense of the material reality of the natural world.

Biologist and animal behaviourist Lynda Birke’s contribution, “Meddling with Medusa: On Genetic Manipulation, Art and Animals”, challenges the notion that making transgenic organisms is radical for any purpose, whether it be for an “art-form” or for the purposes of developmental biology, due to nature’s own complexity. Birke’s related theme concerns the public unease with these activities. She maintains this unease is based not on ignorance, but on a concern over what meanings these reductionist manipulations might have for the future.

UCLA law professor Taimie Bryant’s carefully considered essay outlines the complex and ambiguous relationship between the US legal system and the political and social will to protect animals and nature. The issue of whether “bioart” falls into the category of science or art, while viewed by many critics and supporters in the arts as a marginal issue in contemporary aesthetic thought, becomes a substantive question in any legal action involving the harm done to animals in these projects. Since, as she explains, scientific endeavours receive preferential treatment under the law, artistic collaborations involving scientists or scientific laboratories

undertaken for non-scientific reasons, in many cases, have been protected from such intrusion. As Byrant points out, the landmark 1980 US Supreme court decision of *Diamond vs. Chakrabarty* validating the patentability of genetically altered beings as an inevitable outcome of the “scientific mind” emphasizes the uselessness of the law itself to generate the will to “protect” nature. In fact, as it now stands, US law protects those involved in exploiting animals.

Part III includes investigations of the making of species identity through close readings of novelists’ visions of a genetically controlled future, as well as case studies of our current attitudes, both critical and accepting, towards forays into uses of genetic technologies.

Literary theorist Susan McHugh’s essay included here, “The Call of the Other 0.1%: Genetic Aesthetics and the New Moreaus”, investigates the multiple film versions of the H.G. Wells classic, *The Island of Dr. Moreau*, for clues as to how species has become a primary form of identity previously through genetic breeding and more recently through genetic aesthetics.

Environmentalist Traci Warkentin’s essay investigates the concepts of the natural and the artificial, contamination and purity, integrity and fragmentation through a close reading of Margaret Atwood’s recent dystopian novel, *Oryx and Crake*. Focusing on Atwood’s speculative look at what the future might hold for animals used in current xenotransplantation experiments, particularly pigs, and current trends in factory farming of animals bred for consumption, such as chickens, Warkentin questions the implications of these developing biotechnologies for the future of our embodied sensibilities so necessary for ethical thought and action.

Historian David Deleféntre’s essay provides a historical case study of the activist program in Australasia to ban cosmetic surgery—particularly tail docking and ear cropping—in dogs. While not involving genetic technologies, the issues of “natural breeding”, whether for cosmetic purposes or to breed a dog with traits geared towards human desires, emerge in this discussion as well. The Australian success in bringing the ban into law offers ideas for generating a shift in public opinion towards using animals in genetic technologies or more generally for human uses. Deleféntre sees this as a move towards a more global shift in non-speciest attitudes towards animals.

Landscape architect Kely Miyoshi McKinnon places the “distancing abstraction of contemporary genetic manipulation” within the context of a Batesian ecological understanding of the long history of sheep, humans and the land. This placement allows unique views of both the contemporary methods of “pharming”—the use of genetic engineering to insert genes into plants or animals to produce pharmaceuticals—and human redemption, via the promise of cloning, from the guilt associated with causing the current species extinction.

The promise of redemption is also discussed in Carol Freeman’s “Ending Extinction”. Similar to ethnic cleansing, the mass extinction occurring today is, like the widespread use of genetic technologies, at the fullest reach of human power, control and domination of animals. While projects involving genetic technologies

attempting to revive extinct species such as the Quagga or the Thylacine may initially seem to be possible solutions to current species disaster, Freeman questions the more covert but deep-seated motives of those involved in these projects.

The photographs placed throughout the book are predominantly of my own choosing except for the photos chosen by the authors Carol Freeman, Susan McHugh and Kelty Miyoshi McKinnon for their own essays. The remaining images are from many different sources, some of which are uncredited. My decision to use photos in the original journal version and in this book was based on a desire to ground discussions about the role of animals used in these technologies in the realities of life for them in experimental situations. I chose photos emphasizing the individuality of the animal shown and indications for possibilities for agency and flourishing that were being either controlled or destroyed by their unwilling insertion into the experimental arena. A majority of the photos are not a documentation of animals being used in genetic technology research. This is due to the fact that gaining copyright for a number of photos of genetically modified animals was in most cases denied to me. The controversial nature of their inclusion was cited as a reason. Still, I felt including available photos of animals in experimental situations would attest to the brutality under which laboratory animals live and die.

The roles creativity might play in scenarios of the future loom large since creativity is the human ability on which we have most relied on until now to meet our needs. It is my hope, as editor of this collection, to spark new concepts, combined with more nuanced understanding of animals' right to life and to agency, about sources of creativity we share with animals. It is also my hope that these ideas lead us to very different conclusions about how we might share a future with animals than those now operating in the sciences and arts of genetic biotechnologies. As Henry Beston (1928) so eloquently put it,

For the animal shall not be measured by man. In a world older and more complete than ours, they move finished and complete, gifted with extensions of the senses we have lost or never attained, living by voices we shall never hear. They are not brethren; they are not underlings; they are other nations, caught with ourselves in the net of life and time, fellow prisoners of the splendour and travail of the earth. (20)

Notes

1. See Stuart (2006), Phelps (2007), Lucas (2005), and Ryder (2000).
2. "The number of land-based animals killed for food in 2005 world-wide was approximately 55 billion, according to the U.N. Food and Agriculture Organization. This conservative figure does not account for non-slaughter deaths and under-reporting by developing nations. Again, the many billions of fishes and other aquatic animals killed for food are not reported at all" (as cited in Farm Animal Reform Movement, 2004).
3. See Ryder (2000), particularly Chapters 4 and 5.
4. "An estimated 180 million animals are used in experiments every year across the globe. Not all countries keep accurate records of their animal use, and some official figures are likely to be underestimates. In the USA, for example, 80% of animals used (birds, rats and mice) are

- not included in official figures at all. Across Europe an estimated 13 million animals are used each year, with the UK (nearly 3 million animals) consistently the largest user of laboratory animals. In many cases (including the UK) there are other significant omissions in official statistics. For example, in the UK animals who are bred for research, but subsequently not used, will be killed as ‘surplus’ but not appear in the statistics. Also excluded are animals killed purely for biological products such as blood, or those involved in longer term experiments after the initial first year (any subsequent years of suffering simply disappear from the statistics)” (Dr. Harden Trust, 2008). Also see Knight (2008).
5. An example of this would be a recent announcement of a new “green nanotechnology” in *Nanotechnology Today* (2007). A researcher at University of Cincinnati together with the Air Force Research Laboratory has developed a new approach to making green electronics, salmon sperm. As the researcher points out: “The driving force, of course, is cost. . .” and “Salmon sperm is considered a waste product of the fishing industry. It’s thrown away by the ton”. This researcher thinks that other animal or plant sources might be equally as useful, given the waste of the US agricultural industry.
 6. See Foucault’s (1990) ideas on biopolitics in *History of Sexuality, Volume 1* and see also Esposito (2008) *Bios: Biopolitics and Philosophy*.
 7. Some of the most important studies in this area are Carolyn Merchant’s (1980) *The Death of Nature: Women, Nature and the Scientific Revolution* 1980 and her *Reinventing Eden: The Fate of Nature in Western Culture* (Merchant, 2003).
 8. See also Gigliotti, 2006) “Introduction: Genetic Technologies and Animals”. *AI and Society* 20 (2006): 3–5. Retrieved on February 25, 2007 from <http://www.springerlink.com/content/1435-5655/>
 9. See “What is Critical Animal Studies?” on the Institute for Critical Animal Studies (2008) website. <http://www.criticalanimalstudies.org/?p=6>.
 10. See Susan McHugh, “The Call of the Other 0.1%: Genetic Aesthetics and the New Moreaus” in this volume.

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