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The Stem Cell Debate: Why Should it Matter to Animal Advocates?

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Introduction

The debate over embryonic stem cell research is not commonly associated with nonhuman animals and posthumanist critiques. Rather, the debate revolves around the status of the human embryo and thus is evocative of and closely aligned with the abortion debates in many jurisdictions.[1] Researchers, patients, religious groups, and feminists are interested parties that comprise the face of the debate due to the centrality of the meaning of the human embryo to it. Yet, the abortion debate is not the only controversial realm into which the embryonic stem cell research debate spills over. An infrequently examined dimension to embryonic stem cell research is the human/animal divide it engages and reproduces. We argue that animal advocates should be concerned about embryonic stem cell research because it is intimately connected to and dependent on animal research. In addition to their scientific proximity, the legal regimes of embryonic stem cell research in several jurisdictions are also influenced by issues related to animal research. In the foreseeable future embryonic stem cell research will continue to depend on the use of animals and animal products, but in the long run, embryonic stem cell research may reduce the need for certain types of animal research, especially toxicity and drug testing in animals. As a result, animal advocates' opinions about embryonic stem cell research will likely depend upon their orientation toward either an animal welfarist or rights perspective. Although we adopt a deontological position in this paper, whatever the position eventually preferred, animal advocates should be aware of this eclipsed dimension of embryonic stem cell research and formulate a position accordingly.

Part I of this Article identifies the numerous scientific connections between stem cell research and animal research, pointing out why the former could not have developed without the latter, how embryonic stem cell research remains dependent on animals, and how animals may stand to benefit from such research. Collectively, these connections establish a close nexus between the two research agendas. Part II then moves on to the various policy connections between embryonic stem cell research and animal research through a discussion of the ways in which the real and imagined effects on certain animals involved in agriculture, classified as "endangered," or used in drug testing influence national policy on stem cell research in various jurisdictions. In addition to elaborating our argument that the stem cell research debate engages and reproduces the animal/human divide through these scientific and policy connections between

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1. *See* Janet L. Dolgin, *Embryonic Discourse: Abortion, Stem Cells and Cloning*, 31 FLA. ST. U. L. REV. 101 (2003) (discussing the discursive role of the embryo in debates about abortion and stem-cell research in Western society).

stem cell research and animal research, both Parts I and II of the paper evaluate the possibility that stem cell research may decrease the frequency of and perceived need for animal research. The first two Parts thus lay the background for Part III, which identifies the factors that animal advocates oriented toward a non-instrumental legal and moral status for animals should consider when responding to and/or intervening in the debate over embryonic stem cell research. This Part argues that animal advocates committed to a deontological framework in their posthumanist critiques must resist animal-reliant stem cell research even where possible future benefits of the research would benefit some animals. Discussion then turns to the main issues that nonetheless would likely arise from animal-free stem cell research in the future, which animal advocates should consider.

I. Scientific Connection Between Stem Cell Research and Animal Research

A primary reason animal advocates should attend to the stem cell research debate arises from the prevalence of animal use (and exploitation) in stem cell research. This Part explains the science of stem cells, and then sets out the ways in which scientific knowledge about stem cells depends upon the use of animals.

A. What Are Stem Cells?

Most cells within an animal or human body are committed to fulfilling a specialized function.[2] A muscle cell (or myocyte) is responsible for contraction; a pancreatic islet cell is responsible for producing insulin; a red blood cell (or erythrocyte) is responsible for transporting oxygen and carbon dioxide; and a nerve cell (or neuron) is responsible for processing and transmitting chemical or electrical signals.[3] In contrast, stem cells are a unique and important set of cells that are not specialized.[4] A stem cell "has the ability to reproduce itself for long periods . . . . and give rise to specialized cells that make up the tissues and organs of the body."[5]

2. *See* BRUCE ALBERTS ET AL., MOLECULAR BIOLOGY OF THE CELL 1259 (4th ed. 2002) (a classic in-depth reference textbook in cell biology).
3. *Id.* at 1227-41, 1289-98.
4. *See* NATIONAL INSTITUTES OF HEALTH, STEM CELL: SCIENTIFIC PROGRESS AND FUTURE RESEARCH DIRECTIONS, ES-2 (2001), *available at* http://stemcells.nih.gov/info/scireport/2001report.htm [hereinafter NIH].
5. *Id.*

There are three major types of stem cells: embryonic stem cells, embryonic germ cells and adult stem cells.[6] Embryonic stem cells are cultured using cells drawn from a blastocyst, an embryo four to five days old that consists of fifty to one-hundred-fifty cells.[7] They are pluripotent, meaning they can develop into almost any cell type found in the human body.[8] In 1998, using surplus human embryos from private fertility clinics, James A. Thomson and his team at the University of Wisconsin successfully derived the first human embryonic stem cell lines that could be stably maintained and propagated.[9] As expected, those embryonic stem cells showed signs of immortality and could differentiate spontaneously into diverse tissue types, including gut and neural epithelium, cartilage, bone, and muscle.[10] Since Thomson's project, there has been rapid and exponential growth in the field of embryonic stem cell research, and more than 250 human embryonic stem cell lines have been created worldwide, with approximately one hundred of them created in the United States.[11]

Although similar in some ways to embryonic stem cells, embryonic germ cells and adult stem cells have generated less research and less excitement in the scientific community because their growth and versatility are subject to certain restrictions. Embryonic germ cells are extracted from the gonadal ridge[12] of a fetus at five to ten weeks of age.[13] In theory, these cells, like embryonic stem cells, are pluripotent, but they can survive only seventy to eighty cell divisions in the laboratory and have not been researched as extensively as embryonic stem cells.[14]

Unlike both embryonic stem and embryonic germ cells, adult stem cells are not pluripotent. Found in a wide variety of adult tissues, including the brain, bone marrow, blood, skin, pancreas and liver,[15] they can generate only a limited

6. *Id.*
7. *Id.*
8. *Id.*
9. James A. Thomson et al., *Embryonic Stem Cell Lines Derived from Human Blastocysts*, 282 SCIENCE 1145, 1145–46 (1998).
10. *Id.* at 1146. Immortality in this context means that the cells are not limited to the Hayflick limit, which restricts the number of cell divisions of a normal human cell to approximately fifty times. *See* L. Hayflick, *The Limited* In Vitro *Lifetime of Human Diploid Cell Strains,* EXPERIMENTAL CELL RESEARCH 37: 614, 614 (1965).
11. *The Lure of Stem-Cell Lines*, 442 NATURE 336, 336 (2006). Of the more than two-hundred-fifty human embryonic stem cell lines listed by the journal *Nature*, most were developed in the United States (approximately one hundred), Sweden (fifty-five), Australia (thirty), and United Kingdom (twenty-four).
12. The gonadal ridge contains "primordial germ cells" that later develop into eggs or sperm. *See* NIH, *supra* note 4, at ES-2.
13. *Id.* John Gearhart and his team at the Johns Hopkins University derived the first human embryonic germ cell line in 1998 from fetal tissues obtained via elective abortions. *See* Michael J. Shamblott et al., *Derivation of Pluripotent Stem Cells from Cultured Human Primordial Germ Cells*, 95 PROC. NATL. ACAD. SCI. U.S.A. 13726 (1998).
14. NIH, *supra* note 4, at ES-2.
15. *Id.* at ES-2.

number of cell types, usually those in the tissue or organ where they are located.[16] For example, haematopoietic stem cells from bone marrow or umbilical cord blood can spontaneously develop into several types of blood cells (red blood cells, B-lymphocytes, T-lymphocytes and macrophages), but do not easily develop into neurons, muscle cells, or liver cells.[17] Moreover, adult stem cells exist in very small numbers in adult tissues and are therefore difficult to isolate.[18] Even after adult stem cells have been isolated, they do not grow or divide very well in the laboratory.[19]

Since embryonic stem cells are both versatile and capable of dividing continuously, without being subject to limitations on the number of times they can divide, there is great demand for them in research laboratories. Currently, researchers derive human embryonic stem cells from embryos that were created via *in vitro* fertilization (IVF). An alternative way to create a human embryo is by transferring the nucleus of a somatic cell[20] into the cytoplasm of an egg from which the nucleus has been removed. This procedure is called somatic cell nuclear transfer (SCNT).[21] With proper stimulation, such as an electric shock, an egg behaves as if it has been fertilized.[22] It starts to divide and develop into an embryo, which can then be used in either of two ways.[23] In a process known as therapeutic cloning, embryonic stem cells can be harvested from the embryo for research or therapeutic use; the embryo itself is destroyed in this process.[24] Alternatively, the embryo can be implanted into the uterus of a surrogate for the production of a live offspring, a process called reproductive cloning.[25]

SCNT has been successfully performed in a number of mammalian species,[26] but human SCNT has never been successful. In 2005, South Korean researcher Hwang Woo Suk at Seoul National University announced that he had succeeded in human SCNT and created eleven patient-matched embryonic stem

16. *Id.* at ES-9.
17. Ernest McCulloch, *Normal and Leukemic Haematopoietic Stem Cells and Lineages*, *in* STEM CELL HANDBOOK 119, 123 (Stewart Sell ed., 2004). It has been reported, however, that adult stem cells from the bone marrow can give rise to liver cells and other non-haematopoietic cells under special growth conditions. This phenomenon is termed "stem cell plasticity." *See, e.g.*, B.E. Peterson et al., *Bone Marrow as a Potential Source of Hepatic Oval Cells*, 284 SCIENCE 1168 (1999).
18. NIH, *supra* note 4, at ES-3.
19. *Id.*
20. Any body cell that is not a germ cell (sperm or egg) is a somatic cell. For example, a skin cell is a somatic cell. *See* NIH, Stem Cell Glossary, http://stemcells.nih.gov/info/glossary.asp (last visited July 9, 2007).
21. *See* Ian Wilmut & Lesley Ann Paterson, *Stem Cells and Cloning*, *in* STEM CELL HANDBOOK, *supra* note 17, at 76.
22. *Id.*
23. *Id.*
24. NIH, *supra* note 20.
25. *Id.*
26. Wilmut & Paterson, *supra* note 21, at 76.

cell lines.[27] The news immediately caused a worldwide sensation. But one year later, the result was found to be a fraud.[28] As of today, human SCNT still is not a reality, but researchers in a number of countries, including the United States, United Kingdom, Sweden, China, and South Korea, are racing to achieve it as soon as possible.[29] SCNT is important for the future of stem cell research because it will allow researchers to generate not only an abundant supply of embryonic stem cells, but also patient-matched embryonic stem cells, which are less likely to be rejected by the immune system when they are transplanted into a patient.[30]

More recently, scientists led by Shinya Yamanaka of Kyoto University and James A. Thomson of the University of Wisconsin developed a new technique to generate stem cells much like embryonic stem cells directly from human skin cells without using human embryos.[31] This new technique has the potential to make the current means of generating embryonic stem cells from human embryos obsolete and provide a convenient and inexpensive way to produce patient-matched stem cell lines for therapeutic purposes. However, since the transformation step of the technique requires the injection of four genes which have cancer promoting functions, these induced pluripotent stem cells may turn out to have an elevated risk of tumorigenesis and may not be able to replace the need for conventional embryonic stem cells for use in human therapies.

Embryonic stem cell research has the promise to be revolutionary for both basic science and applied medicine relating to human health. At a more fundamental level, such research has the potential to reveal the origin of human life and the causes of human aging, to unravel the mysteries of embryo development, and to shed light on the etiology of various human diseases. At a more practical level, embryonic stem cell research could also yield novel therapies to treat chronic human diseases such as diabetes, spinal cord injury, heart failure, stroke, osteoporosis, and Parkinson's disease, for many of which no effective treatment is currently available.[32]

27. *See* Hwang Woo Suk et al., *Patient-Specific Embryonic Stem Cells Derived from Human SCNT Blastocysts*, 308 SCIENCE 1777 (2005).

28. *See* David Cyranoski, *Verdict: Hwang's Human Stem Cells Were All Fakes*, 439 NATURE 122 (2006); Nicholas Wade & Choe Sang-Hun, *Human Cloning Was All Faked, Koreans Report*, N.Y. TIMES, Jan. 10, 2006, at A1.

29. Elizabeth Weise, *Cloning Race Is On Again*, U.S.A. TODAY, Jan. 18, 2006, at 9D.

30. NIH, *supra* note 4, at 17.

31. Kazutoshi Takahashi et al., *Induction of Pluripotent Stem Cells from Adult Human Fibroblasts by Defined Factors*, 131(5) CELL 861, 861 (2007); Junying Yu et al., *Induced Pluripotent Stem Cell Lines Derived from Human Somatic Cells*, 318 Science 1917, 1917 (2007).

32. NIH, *supra* note 4, at ES-4 to ES-5.

B. Embryonic Stem Cell Research Could Not Have Developed Without Animal Research

Although the debate about embryonic stem cell research has centered on the status of the human embryo and the specter of human cloning, embryonic stem cell research is inseparable from nonhuman animal research. In fact, a brief review of the history of stem cell research reveals that experimentation on animals has laid the scientific foundation for stem cell research. Perhaps first and foremost, animal research revealed the very existence of stem cells. Two Canadian researchers, James Till and Ernest McCulloch (both at the Ontario Cancer Institute, Toronto), showed the existence of stem cells for the first time while doing Cold War-related research on irradiated mice in the 1960s.[33] They injected fresh bone marrow cells into irradiated mice and observed the formation of lumps in the mice's spleens.[34] They then correctly hypothesized that each lump arises from a single stem cell.[35] Their experiment demonstrated for the first time the presence of haematopoietic stem cells, a type of adult stem cell in the bone marrow, and opened the door for subsequent research, which eventually led to the discovery of the more versatile embryonic stem cells.[36] For their pioneering work, the duo received the 2005 Albert Lasker Medical Research Award, one of the most prestigious awards for biomedical research in the world.[37]

Scientists experimented with animal embryonic stem cells long before derivation of stem cell from human embryos became possible.[38] The derivation of embryonic stem cells from a mouse was conducted in 1981.[39] This was followed by the derivation of embryonic stem cells from other animals such as sheep (1987), hamsters (1988), pigs (1990), rabbits (1993) and monkeys (1995).[40] Animal research like this allowed scientists to better understand the character and idiosyncrasies of embryonic stem cells and to improve their methods

33. *See* A.J. Becker, E.A. McCulloch & J.E. Till, *Cytological Demonstration of the Clonal Nature of Spleen Colonies Derived from Transplanted Mouse Marrow Cells*, 197 NATURE 452, 452-54 (1963).

34. *Id.* at 452.

35. *Id*. at 454.

36. *See* Irving L. Weissman, *The Road Ended Up at Stem Cells*, 185 IMMUNOL. REV. 159 (2002).

37. Bridget Kuehn & Tracy Hampton, 2005 *Lasker Awards Honor Groundbreaking Biomedical Research, Public Service*, 294 JAMA 1327, 1327 (2005).

38. *See, e.g.*, John Gearhart, *New Potential for Human Embryonic Stem Cells*, 282 SCIENCE 1061 (1998).

39. *See* M.J. Evans & M.H. Kaufman, *Establishment in Culture of Pluripotential Cells from Mouse Embryos*, 292 NATURE 154 (1981); Gail R. Martin, *Isolation of a Pluripotent Cell Line from Early Mouse Embryos Cultured in Medium Conditioned by Teratocarcinoma Stem Cells*, 78(12) PROC. NAT'L. ACAD. SCI. U. S. A. 7634 (1981).

40. *See, e.g.*, Thomas Doetschman et al., *Establishment of Hamster Blastocyst-Derived Embryonic Stem Cells*, 127(1) DEV. BIOLOGY 224 (1988); James A. Thomson et al., *Isolation of a Primate Embryonic Stem Cell Line*, 92(17) PROC. NATL. ACAD. SCI. U. S. A. 7844 (1995).

incrementally by working from species less related to humans to species more closely related to humans. This led to the eventual derivation of the first human embryonic stem cells in 1998.[41]

It is also worth noting that IVF technology was first developed in animals. IVF is related to embryonic stem cell research because surplus embryos generated from IVF for reproductive purposes are the main sources of human embryonic stem cells. From the 1950s through the 1970s, numerous IVF experiments were conducted using animals such as rabbits, mice, hamsters, and rats.[42] It was on the basis of such animal experiments that researchers were able to succeed in the first human IVF[43]: on July 25, 1978, Louise Brown, the world's first "test-tube baby," was born in Oldham, England.[44] Today, IVF has become a routine method in fertility clinics worldwide, and more than three-million babies have been born via the procedure.[45] Similarly, SCNT, an important ingredient in any viable agenda to create patient-matched embryos,[46] was first developed in animals. In 1996, Ian Wilmut and his team at the Roslin Institute in Scotland used SCNT to clone a mammal, Dolly the sheep, for the first time.[47] Since then, researchers have cloned a number of other mammals, including cats, goats, cows, mice, pigs, rabbits, horses, deer, mules and gaur.[48] So far, efforts to create a human embryo with SCNT have not been successful, but it is expected that the vast knowledge gained from animal SCNT will eventually allow researchers to succeed in human SCNT.

That animals have been central to the evolution of stem cell research is also evident from the fact that researchers demonstrated the therapeutic potential of stem cell research, which has given the research its elevated status in the public's imagination, through animal models and not human subjects. Animal models are non-human animals with injury or disease similar to a human

41. Thomson, *supra* note 9, at 1145.

42. *See, e.g.*, Min Chueh Chang, *Fertilization of Rabbit Ova in Vitro*, 184 NATURE 466 (1959);. T. Iwamatsu & M.C. Chang, *Factors Involved in the Fertilization of Mouse Eggs* in Vitro, 26 J. REPROD. FERTIL. 197 (1971); R. Yanagimachi & M.C. Chang, *Fertilization of Hamster Eggs* in Vitro, 200 NATURE 281 (1963).

43. Patrick Steptoe & Robert Edwards, Letter to the Editor, *Birth After the Reimplantation of a Human Embryo*, 2 LANCET 366 (1978).

44. *Id.*; *see also* Martin Hutchinson, "*I Helped Deliver Louise*," BBC NEWS, July 24, 2003, http://news.bbc.co.uk/2/hi/health/3077913.stm.

45. Caroline Ryan, *More Than 3M Babies Born from IVF,* BBC NEWS, June 21, 2006, http://news.bbc.co.uk/2/hi/health/5101684.stm (last visited July 9, 2007).

46. *See supra* texts accompanying notes 23-33.

47. K.H.S. Campbell et al., *Sheep Cloned by Nuclear Transfer from a Cultured Cell Line*, 380 NATURE 64 (1996); I. Wilmut et al., *Viable Offspring Derived from Fetal and Adult Mammalian Cells*, 385 NATURE 810 (1997).

48. *See* Jose Cibelli, *A Decade of Cloning Mystique*, 316 SCIENCE 990, 990-92 (2007); Gabor Vajta & Mickey Gjerris, *Science and Technology of Farm Animal Cloning: State of the Art*, 92(3-4) ANIMAL REPROD. SCI. 211 (2006); Wilmut & Paterson, *supra* note 21, at 76.

condition.[49] They are often used to investigate experimental therapeutic procedures that can not be tested directly on human subjects.[50] As of today, no embryonic stem cell-based therapy has been approved for clinical trials in any developed country.[51] However, embryonic stem cell-based experiments in animal models have shown some amazing results.[52] Without animal models to demonstrate the efficacy and safety of embryonic stem cells, embryonic stem cell-based therapies would never be able to move from pre-clinical studies to clinical trials in humans.

Finally, the historical connection between stem cell research and animal research is reflected by the fact that many leading stem cell researchers in the world today were trained in veterinary medicine or animal science. James A. Thomson, the scientist who derived the first human embryonic stem cell line,[53] holds a doctorate in veterinary medicine (D.V.M.) from the University of Pennsylvania and trained at the Oregon National Primate Research Center before

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49. JACK J. PASTERNAK, AN INTRODUCTION TO HUMAN MOLECULAR GENETICS 426-28 (2d ed. 2005).

50. *Id.*

51. Clinical trials are controlled experiments conducted on human subjects to evaluate the safety and efficacy of new drugs or new therapies. In the United States, clinical trials are under the tight control of the Food and Drug Administration (FDA) and local ethics committees called Institutional Review Boards (IRBs), and require the full and informed consent of participating individuals. *See generally*, STUART POCOCK, CLINICAL TRIALS: A PRACTICAL APPROACH (2004). Although embryonic stem cells have not reached the stage for clinical trials, adult stem cells have already been used in a number of clinical settings. For example, haematopoietic stem cells from the bone marrow and umbilical cord blood have been used to treat leukemia and lymphoma. *See* NIH, *supra* note 4, at 51.

52. For example, in one study, human embryonic stem cells were induced into differentiating into cells called oligodendrocytes, which are important in the central nervous system. These cells were injected into partially paralysed rats, after which they migrated to the site of spinal cord damage and formed fully mature oligodendrocytes and myelin sheaths. Within two months, these rats began to show significant improvement in walking ability. Not all the rats in the study showed significant improvement. *See* Dasa Cizkova et al., *Functional Recovery in Rats with Ischemic Paraplegia After Spinal Grafting of Human Spinal Stem Cells*, 147(2) NEUROSCIENCE 546, 546-60 (2007). In another example, scientists converted human embryonic stem cells into the specialized cells that line the base of the retina. When these cells were injected into the retina of rats that suffer from macular degeneration (a retinal degenerative disease that affects one-third of the human population older than seventy-five in the United States), the rats regained vision after five weeks. *See* Raymond D. Lund et al., *Human Embryonic Stem Cell-Derived Cells Rescue Visual Function in Dystrophic RCS Rats*, 8(3) CLONING STEM CELLS 189, 189-99 (2006). In addition to spinal cord injury and macular degeneration, researchers have also treated heart disease, diabetes, stroke, Parkinson's disease and Huntington's disease in animal models using embryonic stem cells. *See* NAT'L INSTS. OF HEALTH, REGENERATIVE MEDICINE (2006), *available at* http://stemcells.nih.gov/info/scireport/2006report.htm.

53. Lamont Williams, *More Than Skin Deep*, N.C.R.R. REPORTER (Nat'l Center for Research Resources, Bethesda, Md.), Winter/Spring 2008, at 12, 13, *available at* http://www.ncrr.nih.gov/publications/ncrr_reporter/winter-spring2008/pdfs/science_advances.pdf.

joining the faculty at the University of Wisconsin.[54] Prior to his breakthrough with human embryonic stem cell research, Thomson worked for many years on the isolation and culture of embryonic stem cells from non-human primates, including rhesus macaques and the common marmoset monkeys.[55] Ian Wilmut, the British scientist who cloned Dolly the sheep in 1996 and who has been granted a licence by the U.K. Human Embryology and Fertilization Authority to use SCNT to create human embryos for stem cell research, holds a Ph.D. in animal genetic engineering from Cambridge University and has conducted extensive research on farm animals, such as sheep and cows.[56] Hwang Woo Suk, the disgraced South Korean scientist who claimed to have succeeded in human SCNT, was trained in veterinary medicine at Seoul National University and worked as a researcher there for many years, attempting to clone cattle and dogs.[57]

C. Embryonic Stem Cell Research *Remains* Dependent on the Use of Animals and Animal Products

Animal research has not only enabled the historical development of stem cell research; it is an integral part of current practices. In the United States, for example, federal funding to human embryonic stem cell research has been limited to those cell lines derived before August 9, 2001.[58] These eligible cell lines—of which seventy-eight exist worldwide, although only twenty-one are actually available to U.S. researchers—are grown on mouse "feeder" cells and in the presence of calf serum.[59] The mouse cells secrete a chemical that allows the human embryonic stem cells to retain their stem cell features.[60] As a result, until scientists discover a way to grow these cells without the use of mouse cells and calf serum, the use of animal cells and animal products will be indispensable for future federally-funded embryonic stem cell research.[61] However, if the current

54. University of Wisconsin Endocrinology-Reproductive Physiology Program, Dr. James Thomson, http://www.erp.wisc.edu/faculty/thomson.html (last visited May 4, 2008).

55. *Id. See also* Thomson, *supra* note 9.

56. Academy of Achievement, Ian Wilmut Biography, http://www.achievement.org/autodoc/page/wil0bio-1 (last visited Apr. 13, 2008).

57. Apoorva Mandavilli, *Profile: Woo Suk Hwang*, 11 NATURE MED. 464 (2005).

58. George W. Bush, Televised Remarks on Stem Cell Research (Aug. 9, 2001), *at* President Discusses Stem Cell Research, http://www.whitehouse.gov/news/releases/2001/08/20010809-2.html (lasted visited Apr. 4, 2008).

59. JUDITH A. JOHNSON & ERIN D. WILLIAMS, CONG. RESEARCH SERV., STEM CELL RESEARCH: FEDERAL RESEARCH FUNDING AND OVERSIGHT at CRS-1 (2007), *available at* http://leahy.senate.gov/issues/medicare/CRS.StemCells.4.2.07.pdf.

60. *Id.* at CRS-11.

61. In privately funded research, scientists developed animal-free embryonic stem cell lines in 2006, but those cell lines are not eligible for federal funding. *See* Tenneille Ludwig et al.,

limit on federal funding to stem cell research is relaxed, researchers will be more likely to switch to some of the animal-free embryonic stem cell lines generated after August 9, 2001.[62]

Due to the numerous technical challenges of developing human embryonic stem cell-based therapies, the vast majority of embryonic stem cell research will continue to be conducted in animal models far into the foreseeable future, as long as the use of animal models is faster, cheaper and more expedient in producing scientific data than non-animal alternatives. Scientists must also demonstrate convincingly to regulatory bodies that stem-cell-based therapies are efficacious and non-toxic in animal models before they can be tested in humans. This means that researchers often have to recreate these human diseases in animals because many human diseases do not occur naturally in animals. Chemical, surgical, and immunologic methods have been used to damage the spinal cord of animals, to induce diabetes, or to simulate heart attacks, stroke, and hypertension. Alternatively, if the gene underlying a human disease is known, the gene may be eliminated or over-expressed in animals to recreate the human disease. Finally, in animal testing of stem cell-based therapies, after the transplantation of stem cells into animal bodies, the animals may have to be euthanized so that researchers can dissect the carcasses and study the stem cells' integration in the animal body. [63]

Given this interface, it is not surprising that in the United States, most National Institutes of Health (NIH) funding for embryonic stem cell research goes to support research on animals rather than humans (see Table 1).[64] This is also true in Canada, where the Canadian Institutes for Health Research (CIHR) currently funds only a few projects on human embryonic stem cell research, but dozens of projects on animal (mostly mouse) embryonic stem cell research.[65]

Derivation of Human Embryonic Stem Cells in Defined Conditions, 24(2) NATURE BIOTECHNOLOGY 185, 185-87 (2006).

62. Lori Gruen & Laura Grabel, *Scientific and Ethical Roadblocks to Human Embryonic Stem Cell Therapies*, 24(10) STEM CELLS 2162, 2162-69 (2006).

63. *See, e.g.*, Cizkova *supra* note 52; Lund *supra* note 52. In addition, embryonic stem cells transplanted into animals frequently give rise to tumors, thus killing the animal rather than improving the animal's health. This has raised serious doubts about the potential utility of embryonic stem cells for human therapy. As a result, extensive animal experiments will be needed to learn how to prevent embryonic stem cells from forming tumors. *See* Michael F. Clarke & Michael W. Becker, *Stem Cells: The Real Culprits in Cancer?*, 295 SCI. AM., 52, 52-59 (2006).

64. JOHNSON & WILLIAMS, *supra* note 59, at 13.

65. *See* CIHR Funding Database, http://webapps.cihr-irsc.gc.ca/funding/search_e (last visited June 19, 2007) (Search result was obtained using keywords "embryonic stem cell," and only operating grants were counted.).

Table 1. NIH Funding for Embryonic Stem Cell Research, Fiscal Year 2003-2008 ($ in millions)[66]

Embryonic stem cell research	FY03	FY04	FY05	FY06	FY07	FY08
Human	20	24	40	38	37	37
Animal	113	89	97	110	110	109

D. Stem Cell Research Could Yield Some Potential Benefits for Animals

Not all of the stem cell research conducted on animals and using animal products is purely anthropocentric; some experiments have the potential to improve the lives of animals. These potential improvements would come in the form of a reduction in animal research, better therapeutic treatment for animals, and the preservation of endangered species.

1. Less Animal Research

Even though stem cell research currently involves instrumental animal use, it has the potential to end certain types of animal testing, a result that animal advocates would welcome. Recall that stem cells have the potential to generate a perpetual supply of human cells of all types for disease modeling, drug discovery, and toxicology testing. These cells can be further genetically or pharmacologically manipulated to create ideal controlled-testing environments. In the United States, the FDA currently requires new drugs to undergo testing on at least two animal species before they are approved for human clinical trials.[67] Animal testing is also required for drug approval in Canada[68] and the European Union.[69] It is likely that progress in stem cell research will convince regulatory bodies to accept *in vitro* preclinical studies involving human stem cells and their derivatives as sufficient to approve new drugs for human clinical trials and thus reduce the number of animals used. In fact, some preliminary progress has already been made in this direction. For example, a method to test the embryotoxic hazards of chemical compounds *in vitro* using embryonic stem cells

66. JOHNSON & WILLIAMS, *supra* note 59, at 13.

67. Food & Drug Admin., The New Drug Development Process, http://www.fda.gov/cder/handbook (follow "New Drug Development Review" hyperlink, then click on "New Drug Development Process," then select "Pre-Clinical Research") (last visited July 3, 2007).

68. Health Canada, How Drugs Are Reviewed in Canada, http://www.hc-sc.gc.ca/dhp-mps/prodpharma/activit/fs-fi/reviewfs_examenfd_e.html (last visited July 3, 2007).

69. Parliament & Council Directive 2001/83/EC, 2001 O.J. (L 311) 67, 67-128.

has been developed and validated in Europe as a partial replacement for animal testing. [70] At the present moment, it is difficult to predict how much and what type of animal testing would be curtailed or eliminated by embryonic stem cell-based testing in the future. The research in this area is too scant to make a sound prediction because scientists are just beginning to learn how to transform embryonic stem cells into differentiated cell types. This dearth of research could also be related to the cost of using human embryonic stem cell lines as many of them are covered by patents or pending patents.[71] As a result, there may not be enough incentive for people to engage in this type of research in order to replace animal testing.

2. Better Therapeutic Treatment for Animals

Stem cell research may also help animals by leading to the development of new stem cell-based veterinary procedures and therapies to treat animal-specific diseases. For example, stem cell-based therapies to treat thoroughbred race horses who have suffered tendon injuries during exercise or racing have been developed and commercialized by two start-up biotech companies, VetCell Ltd. (London, UK) and Vet-Stem Inc. (Poway, CA).[72] According to one such protocol, stem cells are extracted from the horse's own sternum or fat tissues and, after purification and multiplication in the laboratory, are injected back into the animal's injured tendon. The stem cells then may regenerate new tissues and repair the tendon ruptures.[73]

As another example, stem cell research has produced a new way to treat a chronic disease in companion animals. Scientists at a university in Milan, Italy, extracted stem cells from healthy dogs, expanded them in the laboratory and injected them into sick dogs who suffered from a severe form of muscular dystrophy, for which there was no cure.[74] All the treated dogs (ten golden

70. Susanne Bremer et al., *Development of a Testing Strategy for Detecting Embryotoxic Hazards of Chemicals In Vitro by Using Embryonic Stem Cell Models*, 30 ALTERNATIVES TO LABORATORY ANIMALS 107, 107-109 (2002).

71. *See, e.g.*, Serum Free Cultivation of Primate Embryonic Stem Cells, U.S. Patent No. 7,005,252 (filed Mar. 9, 2000); Hematopoetic Differentiation of Human Pluripotent Embryonic Stem Cells, U.S. Patent No. 6,280,718 (Nov. 8, 1999); Human Embryonic Stem Cells, U.S. Patent No. 6,200,806 (filed June 26, 1998); Primate Embryonic Stem Cells, U.S. Patent No. 5,843,780 (filed Jan. 18, 1996).

72. *See* VetCell, Stem Cells, http://www.vetcell.com/stemcells.htm (last visited Apr. 2, 2008); Vet-Stem, Equine Stem Cells, http://www.vet-stem.com/equine/ (last visited Apr. 2, 2008).

73. Ben Hirschler, *Horse Owner Bet on Stem Cell Therapy*, GLOBE AND MAIL, April 30, 2007, at L4.

74. Maurilio Sampaolesi et al., *Mesoangioblast Stem Cells Ameliorate Muscle Function in Dystrophic Dogs*, 444 NATURE 574, 574-75 (2006).

retrievers) showed some degrees of improvements and one dog improved so well that the dog regained the ability to walk 5 months after the treatment.[75]

It should be emphasized that the scientific and commercial goals of these animal experiments are not to benefit the animals themselves, but rather to develop a treatment for humans or to benefit animal owners, thereby reflecting the anthropocentric bias of veterinary stem cell research. For example, after the treatment of the horses mentioned above, they would often be returned to the racetrack, a result which is not in the horses' best interest given the exploitative and unnatural dimensions of the horse racing industry.[76] Nevertheless, this line of research could in the future alleviate animal suffering in order to benefit the animals themselves rather than to facilitate their exploitation.

3. Preservation of Endangered Species

Embryonic stem cell research could also help develop ways to preserve endangered animal species. It is estimated that 11% of bird, 25% of mammal, and 34% of fish species are facing extinction.[77] Despite efforts to maintain biodiversity through habitat and wildlife conservation, approximately one-hundred species become extinct each day.[78] Since some endangered species are not able to reproduce very efficiently, SCNT technology could be used as an alternative means to preserve the species. For example, giant pandas are known to have very low fertility rates both in the wild and in captivity. To circumvent this problem and to maintain the giant panda population, scientists at the Chinese Academy of Sciences are conducting research on using SCNT to clone giant pandas.[79]

For some extremely endangered animal species, where there are very low numbers of available eggs and surrogates, a new procedure called interspecies SCNT may offer the best hope. In interspecies SCNT, the somatic cell nucleus of one animal species (the endangered one) is inserted into the enucleated egg of another animal species (the non-endangered one) to generate an embryo, and the embryo is then implanted into the uterus of a surrogate animal for gestation. In 2000, scientists in the United States used interspecies SCNT to successfully clone the gaur (*Bos gaurus*).[80] The gaur is a large wild ox-like animal in India and

75. *Id.*

76. *See* Kate Hamm, *(Re)Covering Barbaro: American Identity Politics and the Submersion of an Alternative Narrative* (unpublished manuscript, on file with author).

77. *See* Robert P. Lanza et al., *Cloning of an Endangered Species (Bos gaurus) Using Interspecies Nuclear Transfer*, 2(2) CLONING 79, 79 (2000).

78. *Id.*

79. *Panda Cloning Faces Last Hurdle*, BBC NEWS, Nov. 27, 2002, http://news.bbc.co.uk/2/hi/science/nature/2520089.stm.

80. *See also* Robert P. Lanza et al, *Cloning Noah's Ark*, SCI. AM., Nov. 2000, at 84.

Southeast Asia and is on the verge of extinction due to the shrinkage of its native habitat. The scientists transferred the somatic cell nucleus of a gaur bull to the egg of a domestic Iowa cow, and the resulting embryo was carried to term in a surrogate domestic cow.[81] This experiment demonstrated that an endangered species can be cloned even when egg and surrogates of that species are not available. Encouraged by this result, scientists at the Center for Cellular and Molecular Biology in Hyderabad, India, are using the same method to clone the extremely endangered Asian cheetah (*Acinonyx jubatus*), this time recruiting the common leopard as egg donor and surrogate.[82]

Of course, not all animal advocates will view the forcible impregnation of the surrogate female animal as a result that respects the individual flourishing of that animal, even if it helps to reinvigorate endangered animal communities for non-anthropocentric purposes. As we discuss later, a deontological perspective would likely contest this result.[83] A utilitarian framework, however, would be more accepting since it is accustomed to sacrificing the interests of an individual animal for the benefit of the larger group if that result maximizes overall animal flourishing.[84] Under a utilitarian paradigm, then, the role of embryonic stem cell research in revivifying certain species may be seen as ameliorative for animal flourishing.

It is apparent from the above that there are multiple points of interface between stem cell research and animal research. Historically, stem cell research would not have developed to its current position without the use of animal bodies within the research. Currently, stem cell research continues this dependence on animals in research. The scientific connection between stem cell research and animals is not all exploitative of animals, however, since stem cell research has the potential to reduce the incidence of animal research in the future, cultivate therapies for animals, and even preserve endangered species. With these historical and current scientific connections between animal research and stem cell research and the potential benefit of stem cell research to animals in mind, we are poised to consider another area of proximity between stem cell research and the use of animals: how stem cell legislation has been informed by policies related to animal research.

81. *Id.*
82. *India to Clone Cheetah*, BBC News, Oct. 16, 2000, http://news.bbc.co.uk/2/hi/south_asia/974858.stm.
83. *See infra* note 132.
84. *Id.*

II. Policy Connection Between Animal Research and Stem Cell Research Legislation

Most jurisdictions that have significant biomedical research capabilities have enacted laws to regulate one or more of the various activities that comprise what is known as embryonic stem cell research. These activities are (1) human reproductive cloning, (2) human SCNT, (3) creation of human embryos for the purpose of stem cell research, (4) derivation of stem cell lines from existing human embryos, and (5) research using existing human embryonic stem cell lines. A jurisdiction may permit some activities but ban others. Generally speaking, the legal regimes in many Asian countries, such as China, South Korea, Japan, Singapore and India, are permissive, allowing almost all activities except human reproductive cloning.[85] In contrast, some European and North American jurisdictions have restrictive policies for religious or historical reasons.[86] For example, Germany and Italy only allow research using existing human embryonic stem cell lines, while Austria and Poland have banned embryonic stem cell research altogether.[87]

Among common law jurisdictions, Australia,[88] Canada,[89] the United Kingdom,[90] New Zealand,[91] and many states in the United States, including California[92] and Massachusetts,[93] have banned human reproductive cloning. But, human SCNT for therapeutic purposes, which is banned in Canada, is permitted in the United Kingdom and Australia and some states in the United States.[94] The

85. Hinxton Group, World Stem Cell Policies, http://www.hinxtongroup.org/wp.html (last visited Mar. 8, 2008).

86. *Id. See also* Caulfield & Bubela, *infra* note 101, at 51.

87. Hinxton Group, *supra* note 85.

88. Prohibition of Human Cloning Act, 2002.

89. Assisted Human Reproduction Act (AHRA), 2004 S.C., c. 2 (the "*AHRA*").

90. Human Reproductive Cloning Act, 2001, c. 23 (Eng., Wales, N. Ir.).

91. Human Assisted Reproductive Technology Act 2004 ("the HART Act"), 2004 S.N.Z. No. 92.

92. CAL. HEALTH & SAFETY CODE § 24185 (West 2008).

93. MASS. GEN. LAWS ch. 111L, § 8 (2008).

94. Human SCNT is banned in Canada by the AHRA, with guilty persons liable for fines of up to $500,000 and/or ten years in prison. *See* AHRA §§ 5(1)(a), 60. It is permitted in the United Kingdom. *See* HUMAN FERTILISATION AND EMBRYOLOGY AUTHORITY, REGULATION OF RESEARCH ON HUMAN EMBRYOS (2001). In Australia, human SCNT was initially banned in 2002, but the ban has been lifted by the Prohibition of Human Cloning for Reproduction and the Regulation of Human Embryo Research Amendment Act 2006, scheds. 1-2 (amending the Prohibition of Human Cloning Act 2002 and Research Involving Human Embryos Act 2002), following an independent review chaired by former federal court judge John Lockhart. In New Zealand, human SCNT is not a prohibited activity in the HART Act of 2004; however, the HART Act has established an Advisory Committee on Assisted Reproductive Technology (ACART) to deal with this matter, and the ACART has yet to make a decision on SCNT. In the United States, there are currently no federal laws which ban human SCNT. It is banned in some states (Arkansas, New Hampshire, Indiana, Virginia, Florida, Michigan, Louisiana, Pennsylvania, North Dakota and South Dakota),

United Kingdom permits the creation of human embryos for the purpose of stem cell research,[95] but such practice is prohibited in Canada,[96] Australia (when the embryo is created by fertilization of a human egg by a human sperm),[97] and New Zealand.[98] With respect to existing embryos, the United Kingdom, Canada, and Australia all permit the use of surplus IVF embryos for the derivation of embryonic stem cell lines.[99] In the United States, there is currently no *federal* ban on the creation of human embryos for research purposes or the derivation of human stem cell lines from surplus IVF embryos, but the Dickey Amendment prohibits the use of federal funds for the creation of human embryos for research purposes or for research which may destroy or injure human embryos.[100] The use of existing human embryonic stem cell lines seems to cause the least controversy. The United States, United Kingdom, Canada, Australia and New Zealand all permit the use of existing human embryonic stem cell lines.[101]

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but permitted in others (California, New Jersey, Connecticut, Massachusetts, Illinois, Maryland, Missouri and Rhode Island). *See* Hinxton Group, *supra* note 84.

95. Human Fertilisation and Embryology Act, 1990, c. 37, sched. 2, § 3.

96. AHRA, § 5.

97. Prohibition of Human Cloning Act, § 14. ("A person commits an offence if the person intentionally creates a human embryo outside the body of a woman, unless the person's intention in creating the embryo is to attempt to achieve pregnancy in a particular woman.") This provision is modified by the Prohibition of Human Cloning for Reproduction and the Regulation of Human Embryo Research Amendment Act, 2006, sched. 2, § 15, which permits the "creation of human embryos other than by fertilisation of a human egg by a human sperm" under a license.

98. HART Act, sched. 1, § 1.

99. In the United Kingdom, the Human Fertilisation and Embryology Act, 1990, c. 37, established the Human Fertilisation and Embryology Authority (HEFA) in 1991. Researchers who wish to work on human embryos must apply for a licence from HEFA. In Canada, the AHRA also created a regulatory agency known as the Assisted Human Reproduction Canada (AHRC) which will issue licenses to researchers who wish to derive stem cells from human embryos. A similar regulatory scheme is also in place in Australia pursuant to the Research Involving Human Embryos Act, 2002.

100. *See, e.g.,* Consolidated Appropriations Acts of 2005, Pub. L. No. 108-447,§ 509, 118 Stat. 2809, 3163-64 (2004). The Dickey Amendment is federal legislation that prohibits the use of federal funds for "(1) the creation of a human embryo or embryos for research purposes; or (2) research in which a human embryo or embryos are destroyed, discarded, or knowingly subjected to risk of injury or death greater than that allowed for research on fetuses *in utero*." It is a rider to other federal appropriation legislation and has been passed annually by Congress since 1997.

101. In the United States, there is currently no federal ban on the use of existing human embryonic stem cell lines. However, President George W. Bush announced on August 9, 2001, that federal funds could only be used for research on human embryonic stem cell lines created before that date, but not those created after that date. *See supra* note 58. This announcement does not affect the use of state or private funds on human embryonic stem cell lines. At the state level, the statutes of most states appear to permit research on existing embryonic stem cell lines. *See* Hinxton Group, *supra* note 85.

Table 2. Comparison of legal regimes in major common law jurisdictions

	United Kingdom	Australia	New Zealand	Canada	United States	California
Human reproductive cloning	No	No	No	No	Unregulated	No
Human SCNT	Yes	Yes	Undecided	No	Unregulated	Yes
Creation of human embryos for stem cell research	Yes	No	No	No	Yes, but no federal funds	Yes
Derivation of embryonic stem cell lines from human embryo	Yes	Yes	Yes	Yes	Yes, but no federal funds	Yes
Use of existing embryonic stem cell lines	Yes	Yes	Yes	Yes	Yes, but no federal funds for those created after August 9, 2001	Yes

A review of the legislative histories of embryonic stem cell laws in the major common law jurisdictions reveals that legislators focus on the moral/legal status of the human embryo and commodification concerns. For example, the parliamentary debate in Canada on the Human Assisted Reproductive Technology Act has focused almost exclusively on the moral status of the embryo, even though Health Canada, the sponsoring ministry, rationalized the Act on the basis of the anxiety of human commodification and the potential of health risk to Canadians.[102] For instance, Health Canada stated in its overview of

102. Timothy Caulfield & Tania Bubela, *Why a Criminal Ban? Analyzing the Arguments against Somatic Cell Nuclear Transfer in the Canadian Parliamentary Debate*, 7(2) THE AM. J. OF BIOETHICS 51, 51-61 (2007) ("giv[ing] a comprehensive and systematic legal analysis of the legislative process and parliamentary debates associated with the passage" of the AHRA in Canada and considering why a plural democracy could enact such a statutory prohibition backed up by severe penalties).

the AHRA draft legislation that "Canadians also want to be sure that researchers don't push the frontiers of science past acceptable ethical limits. And they want reassurance that Canada will not allow human life to be traded, bartered or in any other way commodified."[103] The moral status of the embryo has also dominated the debate in the United States over embryonic stem cell research.[104]

Yet the specific contours of the legislation did not derive solely from concerns over the beginning of human life and to what extent human bodies can be traded. In a number of jurisdictions, issues related to animal research have informed embryonic stem cell legislation, such as the Human Fertilization and Embryology Authority Regulation of Research on Human Embryos in the United Kingdom, the HART Act 2004 in New Zealand, and the Research Involving Human Embryo Act and the Prohibition of Human Cloning for Reproduction and the Regulation of Human Embryo Research Amendment Act in Australia. We have identified three major issues related to animal research that have informed such stem cell research legislation. While no less anthropocentric, the reasons foreground the importance of animal bodies to the debate about legitimating embryonic stem cell research.

A. Desire to Generate Better Farm Animals

Just as advances in animal research have been applied to embryonic stem cell research, advances in embryonic stem cell research can also be applied to animal research conducted to facilitate animal use. The desire to generate better farm animals was mentioned positively in the Australian House of Representatives Legal and Constitutional Affairs Committee 2001 report on human cloning and stem cell research.[105] In New Zealand, the discussion document on stem cell research commissioned by the Council of the Royal Society of New Zealand also mentioned that stem cell research could be used to produce better farm animals.[106] More specifically, the document states that stem cell research could help "produce high quality genetic st[r]ains which are free

103. HEALTH CANADA, PROPOSALS FOR LEGISLATION GOVERNING ASSISTED HUMAN REPRODUCTION: AN OVERVIEW 1-2 (2001), *available at* http://www.hc-sc.gc.ca/ahc-asc/alt_formats/cmcd-dcmc/pdf/media/releases-communiques/2001/repro_over.pdf.

104. Dolgin, *supra* note 1, at 161-62.

105. AUSTL. H.R. STANDING COMM. ON LEGAL AND CONST. AFFAIRS, HUMAN CLONING: SCIENTIFIC, ETHICAL AND REGULATORY ASPECTS OF HUMAN CLONING AND STEM CELL RESEARCH 22, 64 (2001), *available at* http://www.aph.gov.au/house/committee/laca/humancloning/report.pdf (anticipating the "production of animals that . . . produce milk or meat with enhanced nutritional value" and other "longer term applications in agriculture and food").

106. R. STEWART GILMOUR, EMBRYONIC STEM CELLS AND HUMAN THERAPEUTIC AND REPRODUCTIVE CLONING (2001), http://www.rsnz.org/topics/biol/stem/discuss.php.

from diseases including prion diseases associated with transmissible encephalopathies."[107] The reference to the production of better farm animals is not surprising, given that industries related to sheep and cows are such a vital part of the economy in Australia and New Zealand. In 2006, Australia was home to over twenty-six million "beef" cattle raised for their flesh and over sixty-seven million sheep.[108] In 2004 and 2005, Australia was the world's second largest exporter of beef and the world's largest supplier of wool.[109] In 2007, New Zealand was home to over thirty-eight million sheep, over five million "dairy" cows, and over four million "beef" cattle.[110] Both countries are well known for breeding "superior" animal strains. For example, the Australian Merino sheep, which was created by Australian farmers through many years of conventional breeding, produces the finest wool fiber in the world, and Merino wool has dominated the world high-end wool market.[111] Embryonic stem cell research could potentially transform conventional breeding methods, allowing Australia and New Zealand to develop even "better" animal strains.

B. Desire to Reduce Drug Testing in Animals

A further example of the way that animal issues inform stem cell policy is the desire to reduce the need to test drugs intended for human use on animals. Development of a new drug product is an expensive and time-consuming business.[112] In the United States, Canada, and the European Union, before a new drug can be approved for clinical trials in humans, it must be tested in animals to demonstrate its efficacy and safety. As mentioned above, the FDA requires a new drug be tested on at least two animal species before granting it approval for clinical trials.[113] Both pharmaceutical companies and animal advocacy groups want to reduce the amount of testing in animals, but for very different reasons.

107. Prion diseases include scrapie in sheep and mad cow disease in cattle. *Id.*

108. AUSTL. BUREAU OF STATISTICS, YEAR BOOK AUSTRALIA 2008, at 491, *available at* http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1301.02008?OpenDocument (follow "Free Download" hyperlink).

109. Australia Now—Australian Agriculture, Fisheries, and Forestry, http://www.dfat.gov.au/facts/affaoverview.html (last visited Mar. 15, 2008).

110. Ministry of Agriculture and Forestry, Livestock Statistics, http://www.maf.govt.nz/statistics/pastoral/livestock-numbers/index.htm (follow appropriate links) (last visited Mar. 15, 2008). New Zealand is the world's second largest exporter of wool (behind Australia). Ministry of Agriculture and Forestry, Wool Production in New Zealand, http://www.maf.govt.nz/mafnet/rural-nz/overview/nzoverview009.htm (last visited Mar. 15, 2008).

111. *See* DAVID CREAN & GEOFF BASTIAN, SHEEP MANAGEMENT AND WOOL PRODUCTION (1996).

112. It is estimated that it takes over $800 million on average to research and develop a new drug. *See* Joseph A. DiMasi et al., *The Price of Innovation: New Estimates of Drug Development Costs*, 22(2) J. HEALTH ECON. 151, 151 (2003).

113. FDA, *supra* note 51.

For pharmaceutical companies, animal testing is expensive and creates bad publicity.[114] For animal advocacy groups, animal testing is cruel and unethical.[115] As mentioned earlier, embryonic stem cells can generate a perpetual supply of differentiated and undifferentiated cells. Thus, a new drug could potentially be tested on many different cell types, all derived from embryonic stem cells, to determine its pharmacological and toxicological effect on these cell types.

In fact, in the United States, the National Bioethics Advisory Commission (NBAC), which was created to advise the President on ethical issues related to biomedical science and technology, stated in its 1999 report on stem cell research, "Human stem cell research offers promise for use in testing the beneficial and toxic effects of biologicals, chemicals, and drugs in the most relevant species for clinical validity – humans."[116] The report also quoted a statement by Harold Varmus, then Director of the NIH, who said at a congressional hearing: "Human pluripotent stem cell research could . . . dramatically change the way we develop drugs and test them for safety and efficacy. Rather than evaluating safety and efficacy of a candidate drug in an animal model of a human disease, these drugs could be tested against a human cell line that had been developed to mimic the disease process."[117]

Similarly, in Australia, the Lockhart Report stated: "Human [embryonic stem] cell-based in vitro screening models are being developed for testing the chemical toxicity and pharmacological action of chemical agents. Such systems have not yet been widely used or tested, but further development may allow researchers to test drugs and potential chemical toxins without the use of animals."[118] In New Zealand, a discussion document on stem cell research commissioned by the Council of the Royal Society of New Zealand stated that "[t]he ability to evaluate drug action in human cell lines grown from [embryonic stem] cells would greatly reduce the need for tests in animal models."[119]

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114. *See, e.g.*, GlaxoSmithKline Corporate Responsibility Report 2004, at 98 (2005), http://www.gsk.com/responsibility/Downloads/CR_Report_2004.pdf (assuring readers of the company's commitment to "reduction, refinement and replacement" of animal testing).

115. *See, e.g.*, People for the Ethical Treatment of Animals, Animals Used for Experimentation FAQs, http://www.peta.org/about/faq-viv.asp (last visited Mar. 15, 2008).

116. NAT'L BIOETHICS ADVISORY COMM'N, , ETHICAL ISSUES IN HUMAN STEM CELL RESEARCH 23 (1999), *available at* http://bioethics.georgetown.edu/nbac/stemcell.pdf.

117. *Id.* at 94.

118. LEGIS. REV. COMM., LEGISLATION REVIEW: PROHIBITION OF HUMAN CLONING ACT 2002 AND RESEARCH INVOLVING HUMAN EMBRYOS ACT 2002, at 43 (2005) [hereinafter Lockhart Report, after the committee chair], *available at* http://www.lockhartreview.com.au/reports.html (follow "Full Documents" hyperlink).

119. GILMOUR, *supra* note 106.

C. Desire to Preserve Endangered Animal Species

Australia is geographically isolated from the rest of the world. As a result, Australia has very distinct fauna such as kangaroos, platypi, and koalas – animals which are not found in any other continents. In addition to these well-known species, Australia is also home to many lesser-known animal species, such as the Tasmanian devil, bilby, numbat, leadbeater's possum, bandicoot, tiger quoll, mala, wallaby, and potoroo.[120] Many of these unique animal species are facing the danger of extinction because of the human destruction of their habitat and the competition from non-native animals.[121] The desire to preserve endangered animal species may be one of the factors that motivated the Australian Parliament to broaden the scope of embryonic stem cell research to include SCNT in 2006. The Lockhart Report states that "work on interspecies nuclear transfer" may "help clone endangered species, where there are low numbers of available oocytes and surrogates."[122]

To summarize the argument thus far, animal research is intimately interwoven with the stem cell research agenda. Stem cell research has come of age based on the foundation of decades of animal research. Yet, stem cell research will continue to depend on animal research in the foreseeable future. Animal-related policy issues have also influenced the laws of stem cell research in several jurisdictions. Given the importance of animal research to the stem cell research agenda, it is time for animal advocates oriented toward a non-instrumental legal and moral status for animals to formulate a position in response to the debate over stem cell research.

III. Animal Advocacy in the Stem Cell Research Debate

The reliance of stem cell research on animal bodies and animal research prompts animal advocates to consider whether they should object to animal-reliant stem cell research. The authors support the promotion of "animal flourishing," an egalitarian state of dignity where animals are able to live their own lives on their own terms with their own capabilities. An answer to the question of whether stem cell research enables the development of post-human ethical practices that foster animal flourishing hinges largely on whether a

120. Australian Department of the Environment, Water, Heritage and the Arts, EPBC Act List of Threatened Fauna, http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=fauna (last visited Mar. 15, 2008).

121. AUSTRALIAN NATIONAL PARKS AND WILDLIFE SERVICE, ENDANGERED VERTEBRATES OF AUSTRALIA AND ITS ISLAND TERRITORIES (1984).

122. Lockhart Report, *supra* note 118, at 58.

utilitarian or a deontological approach is adopted.[123] A utilitarian approach, which would permit the sacrifice of some animals if the global amount of animal suffering were reduced, might well tolerate the use of animal models and cultures to support a stem cell agenda that might obviate the "need" for animal research down the road. By contrast, a rights approach insists, as it does for humans, that animals are ends in and of themselves and that one single animal should not be harmed even if doing so would be beneficial for all other nonhuman animals. As ends themselves, animals should not be used as mere instruments for human purposes; rather they should be extended the ethical consideration accorded to humans.[124] To the extent that animal flourishing and well-being demand a deontological orientation (a debatable point, but one which we will assume for the purposes of this article), embryonic stem cell research is problematic because it still involves instrumental animal use as detailed above.[125] Animal advocates committed to deontology or "animal rights" should thus find animal-reliant stem cell research objectionable.

This holds even if the animal-reliant stem cell research could potentially benefit other animals. The deontological prohibition of the mere instrumental use of animals applies even when such use could improve the overall flourishing of other (nonhuman) animals. For example, part of a robust biotechnological agenda could mean accelerating the replenishment and revival of endangered species through the type of cloning contemplated in embryonic stem cell research.[126] To utilitarian animal advocates, this would very likely be desirable not because of the benefit of biodiversity to humans, which is the standard rationale proffered for endangered species legislation and pleas for funding, but because of the benefit to members of an endangered species and to other species

123. The term "animal flourishing" is an adaptation of Margaret Jane Radin's "human flourishing." Although theoretically separate, Radin's "human flourishing approach" to thinking about human well-being is similar in some respects to Nussbaum's "capabilities approach" to human justice problems. Likewise, our extension of animal flourishing shares some tenets of Nussbaum's recent extension of the "capabilities approach" to animals, but not all. We are less concerned here with what precisely animal flourishing would look like for all animals at all levels of functioning and so do not offer a detailed comparison and contrast of Radin's and Nussbaum's approaches; rather, we invoke them as general models for animal well-being. For more detailed discussions, see MARGARET JANE RADIN, CONTESTED COMMODITIES: THE TROUBLE WITH TRADE IN SEX, CHILDREN, BODY PARTS AND OTHER THINGS (1996); MARTHA C. NUSSBAUM, FRONTIERS OF JUSTICE: DISABILITY, NATIONALITY, SPECIES MEMBERSHIP (2006).

124. Peter Singer is the most well-known contemporary advocate for animals through the utilitarian preference model (although he is ironically often associated with animal rights), while Tom Regan's work is often presented as the exemplar of a deontological view of animals. *See generally* PETER SINGER, ANIMAL LIBERATION (2d ed. 1990); TOM REGAN, THE CASE FOR ANIMAL RIGHTS (1983).

125. *See supra* Part I.

126. *See supra* text accompanying notes 77-84.

living in connected relationships with those nonhuman members.[127] While the anthropocentrism of this application of stem research is eliminated, problems still persist for animal advocates operating within a deontological framework. This is so because the process by which this regeneration takes place could involve the harnessing of female animal bodies as surrogates to grow the endangered embryos of another species.[128] As feminists have noted with respect to human female surrogates, surrogacy carries health and psychological risks even when interspecies reproduction is not contemplated and the surrogates consent to the surrogacy.[129] A utilitarian approach to animal advocacy would take a more favourable view of using an individual female animal to elude extinction of her or another species than would a deontological position. As it is our contention that the promotion of animal flourishing should be understood deontologically, animal advocates should not support animal-reliant stem cell research despite any benefits to animals as a group.

IV. Animal-Free Stem Cell Research

This then leads to the question: what if researchers could carry out stem cell research without reliance on animal bodies or body parts? Would stem cell research then be something that animal advocates should support? In this Part, we set out several important factors for animal advocates to consider in answering this question.

A. Impact on Human Rights and Intra-Human Hierarchies

There are multiple reasons to criticize stem cell research from a progressive, rather than pro-life or otherwise conservative, agenda. These reasons note the negative effects that a robust program of stem cell research may visit upon marginalized human groups on the basis of ability, class, race, and gender. The potential of stem cell research to exacerbate existing intra-human social inequities is a compelling reason on its own to oppose such research. But given that injustices against animals are themselves exacerbated by human injustices,[130] the manner in which human hierarchies are mitigated or assisted by

127. *See* Holmes Roslton III, *Duties to Endangered Species*, 35 BIOSCIENCE 718, 724 (1985) ("It is not preservation of *species* but of *species in the system* that we desire.").

128. *See supra* text accompanying notes 80-83.

129. Dan R. Reilly, *Surrogate Pregnancy: A Guide for Canadian Prenatal Health Care Providers*, 176 CMAJ 483, 484-85 (2007) (citing recent medical literature indicating that surrogate pregnancy is a high-risk psychological experience that may also cause obstetric risks). See *infra* note 134 as well.

130. *See* CAROL J. ADAMS, THE SEXUAL POLITICS OF MEAT: A FEMINIST-VEGETARIAN CRITICAL THEORY (1991) (discussing how patriarchal violence against women and the slaughter of animals

stem cell research is a *doubly* important issue for animal advocates to consider. Space does not permit a full discussion of these connections between animal and human oppressions here, but what may briefly be noted is: 1) both animals and marginalized human groups are "Othered" by narratives that rely on problematic Cartesian binaries (culture/nature, reason/emotion, mind/body, etc.) that position them as inferior to white, western, able-bodied, and affluent men (who are seen to embody the elevated side of these binaries); and 2) social constructions of difference along gender, ability, class, race *and* species lines are mutually constitutive.[131]

With respect to the relationship between stem cell research and disability, the former's focus on attaining a disease-free life could easily blur with the desire for a remedy against "aging" and disabilities, a result that many disability rights advocates would contest as a medicalized model of disability that misunderstands disability and devalues the lives of people with disabilities.[132] Similarly, with regard to gender, feminists have worried about the considerable risks to women involved in the procurement of eggs, a process that an expansive

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contribute to each other); ANIMALS AND WOMEN: FEMINIST THEORETICAL EXPLORATIONS (Carol J. Adams & Josephine Donovan eds., 1995) (collection of essays elaborating on the connections between feminism and animal issues); Maneesha Deckha, *The Salience of Species Difference for Feminist Theory*, 17 HASTINGS WOMEN'S L.J. 1 (2006) (arguing that feminists and other advocates of human rights must attend not only to race, gender, and the like but also to "species difference" and the treatment of non-human animals).

131. Deckha, *supra* note 130, at 22-37.

132. *See* Melinda Cooper, *Resuscitations: Stem Cells and the Crisis of Old Age*, 12 BODY SOC'Y 1 (2006) (discussing the ways in which stem cell research commercializes life itself); G. Goggin & C. Newell, *Uniting the Nation? Disability, Stem Cells, and the Australian Media*, 19 DISABILITY & SOC'Y 47 (2004) (criticizing the media for not including disabled people in the discussion of stem cell research); Disabled People's International, The Right to Live and Be Different, http://www.independentliving.org/docs1/dpi022000.html (last visited May 5, 2008) ("[Over one-hundred] disabled people and parents, delegates from . . . twenty-seven countries . . . , [make the following declaration:] . . . We are full human beings. We believe that a society without disabled people would be a lesser society. Our unique individual and collective experiences are an important contribution to a rich, human society. We demand an end to the bio-medical elimination of diversity, to gene selection based on market forces and to the setting of norms and standards by non-disabled people."). Of course, not all disability rights advocates are against conventional standards of "normalcy" and thus have supported embryonic stem cell research. Catherine Waldby & Susan Squier, *Ontogeny, Ontology, and Phylogeny: Embryonic Life and Stem Cell Technologies*, 11 CONFIGURATIONS 27, 39 (2003).

regime stem cell regime would require.[133] Specifically, the commodification and health concerns for women involved in egg procurement are significant.[134]

Additionally, with respect to class and race, when one considers the demographic that stands to benefit from more stem cell research, it is apparent that it is an elite and small portion of the world's population located in primarily affluent nations which have the resources necessary to conduct such technocentric research projects.[135] Indeed, it could be argued that what would best aid global health and respond to the bioethical call is not to fund stem cell research that will possibly benefit only privileged citizens and residents of rich nations, but to spend an equivalent amount of money on primary health care in poor nations.[136] Yet, the latter issue is not typically regarded as within the scope of bioethical inquiries. Despite recent efforts to integrate the two, bioethics is not widely perceived as related to international human rights.[137] Devoting more attention, resources, and energy to the issues that benefit affluent Western populations, such as stem cell research, may further obscure the importance of the type of health problems arising from poverty, malnutrition, and infectious diseases.

Related to these concerns is the issue of how stem cell research implicates biopolitics. Biopolitics is the idea, originating with Foucault, that the body is a prime arena through which governments control their populations, sometimes

133. *See, e.g.*, Renate Klein, *Dangers of Harvesting Human Eggs Clouded in Cloning Debate*, CANBERRA TIMES (Austl.), Nov. 8, 2006; Roxanne Mykitiuk, Jeff Nisker & Robyn Bluhm, *The Canadian Assisted Human Reproduction Act: Protecting Women's Health While Potentially Allowing Human Somatic Cell Nuclear Transfer into Non-Human Oocytes*, 7 AM. J. BIOETHICS 71 (2007); Judy Norsigian, *Egg Donation for IVF and Stem Cell Research: Time to Weigh the Risks to Women's Health*, DIFFERENTAKES SERIES (Population and Development Program, Amherst, Mass.), Spring 2005, *available at* http://popdev.hampshire.edu/sites/popdev/files/dt/DifferenTakes_33.pdf.

134. *See* ASSESSING THE MEDICAL RISKS OF HUMAN OOCYTE DONATION FOR STEM CELL RESEARCH: WORKSHOP REPORT (Linda Giudice et al. eds., 2007).

135. *See* K. Cregan, *Ethical and Social Issues of Embryonic Stem Cell Technology*, 35 INT'L MED. J. 126, 127 (2005) (arguing that based on the past record of multinational pharmaceutical corporations in the global South, such as their withholding of generic medications for HIV/AIDS in South Africa, the vast majority of the population in Southern countries is unlikely to benefit from the fruit of embryonic stem cell research).

136. *See* Mattias Ganslandt, Keith E. Maskus & Eina V. Wong, *Developing and Distributing Essential Medicines to Poor Countries: The DEFEND Proposal*, 24 WORLD ECON. 779 (2001).).

137. Nikolas Rose, *Molecular Biopolitics, Somatic Ethics and the Spirit of Biocapital*, 5(1) SOC. THEORY & HEALTH 3, 16 (2007). *See also* Soloman Benatar, Abdallah Daar, & Peter A. Singer, *Global Health Challenges: The Need for an Expanded Discourse on Bioethics*, 2(7) PLOS MED. e143 (2005); Michael Peel, *Human Rights and Medical Ethics*, 98(4) J. ROYAL SOC'Y MED. 171 (2005); Howard Wolinksy, *Bioethics for the World*, 7(4) EMBO REPS. 354 (2006); Michael Yesley, *What's in a Name? Bioethics – and Human Rights – at UNESCO*, 35 HASTINGS CTR. REP. 8 (2005). . The same may be said of public health ethics. Stephanie Nixon and Lisa Forman, *Exploring Synergies Between Human Rights and Public Health Ethics: A Whole Greater Than the Sum of Its Parts*, 8 BMC INT'L HEALTH & HUM. RTS., art. no. 2 (2008).

utilizing the bodies and lives of other populations in so doing.[138] As Nikolas Rose argues, the molecular-centeredness of contemporary biomedicine has not just reinvented our sense of corporeality, but has also invited an intensification of regulatory regimes and venture capital involvement in helping to realize and legitimate the hoped-for commodified results of the research.[139] Never before has medicine generated so much "biovalue," raising hopes of profit for private investors and hopes of robust economies for the states that permit the contested technologies to flourish within their jurisdictions.[140] And, expectedly, pharmaceutical companies sponsor trials of non-Western populations living in economically poorer nations eager to relax regulatory standards and participate in this dimension of the knowledge economy, routing the results into the development of profitable products protected by intellectual property rights to market in rich nations.[141] Although a full discussion of the biopolitical implications of embryonic stem cell research is not possible here, it is important to note the effect of it with respect to power relations and the ways in which we are governed by others and govern ourselves. The concerns about biopolitics, coupled with general human rights concerns based on ability, gender, race and class, are issues animal advocates need to keep in mind in evaluating the impact of animal-free stem cell research on animals.

B. The Human Embryo-Nonhuman Animal (Misguided) Analogy

It might be suggested that another salient reason animal advocates should be wary of stem cell research arises from the need to align with pro-life advocates given the slippery "personhood" slope between human embryos and animals. This suggestion arises from the argument that to the extent stem cell research entrenches an instrumental view of embryos because they are not fully "human" or "persons," it promotes the instrumentalization of all socially-produced "marginal states of life" whose humanity and personhood are in

138. SARA MILLS, MICHEL FOUCAULT 82-84 (2003). *See* also Mark Kelly, *Racism, Nationalism and Biopolitics: Foucault's* Society Must Be Defended, 4 CONTRETEMPS 58, 59-60 (2004), *available at* http://www.usyd.edu.au/contretemps/4september2004/Kelly.pdf. *See also* Thomas Lemke, '*The Birth of Bio-politics': Michel Foucault's Lecture at the Collège de France on Neo-liberal Governmentality,* 30 ECON. & SOC'Y 190, 191 (2001) (describing Foucault's idea of "governmentality" as including a wide range of control techniques, from one's control of the self to the "biopolitical" control of populations).

139. Rose, *supra* note 137, at 17-18.

140. *Id.* at 17-19.

141. *Id.* at 20. *See also* Cooper, *supra* note 132, at 16; LORI ANDREWS & DOROTHY NELKIN, BODY BAZAAR: THE MARKET FOR HUMAN TISSUE IN THE BIOTECHNOLOGY AGE (2001) (analyzing exploitations occurring both in the United States and abroad).

doubt, including animals.[142] According to this argument, stem cell research allows "inhuman vitality"—in the form of embryos—to be "reorganized and exploited" by paradigmatic human actors,[143] paving the way for the exploitation of the "inhuman vitality" of animals.

Gary Francione has explained why these analogies between human embryos and animals and between a pro-life position and an animal rights position are false.[144] While not foreclosing ethical discussion on abortion, Francione distinguishes a human fetus (and, by implication, an embryo) from a born nonhuman animal simply because the latter is already born and not residing in the body of another being/person. He stresses that the complications of a living entity, even if it is considered a full legal person, being dependent on another person (the woman) and thus properly subordinate to her decisions about her body do not arise in the treatment of animals. Thus, he concludes that the fears some feminists harbor about supporting animal rights—fears about the implications of their support for a position that must value all life in all its forms, including human embryos—are misguided.[145] Similarly, animal rights advocates should not regard the pro-life movement as a natural ally with which they must side in a debate, whether the debate is about abortion or stem cell research.[146]

C. Potential for Reduction in Animal Research and Improvement of Animal Therapies

A main consideration for animal advocates to factor into an overall assessment of the ethics of animal-free stem cell research is its ability to reduce the use of animals in research about human disease prevention as well as its ability to increase therapeutic treatments for animals. To the extent animal-free

142. *See* Waldby & Squier, *supra* note 132, at 29 (comparing the embryos used in stem cell research to donor cadavers and fetuses, in that they all "reside at the margins of human life, and their relationship to the human community . . . is ambiguous and contestable").

143. *Id.* at 33.

144. *See* Gary L. Francione, *Abortion and Animal Rights: Are They Comparable Issues?, in* ANIMALS AND WOMEN, *supra* note 130, at 149, 150.

145. *Id.*

146. It should be noted that not all those opposed to abortion are against embryonic stem cell research. Many pro-life Republicans have disagreed with President Bush's prohibitory position due to the possibility that stem cell research will reverse life-threatening illnesses and diseases. The logic of a pro-life proponent who supports embryonic stem cell research is more apparent if one considers that, arguably, the abortion debate is not about the status of the embryo at all, but the status of women and a certain gendered heteronormative vision of the ideal social order. Since the alignment of gender roles, the meaning of the family, and the organization of society are not seen to be at stake in embryonic stem cell research, pro-life proponents are able to sanction the instrumental use of embryos and even cast their concern about saving people by repairing diseased or damaged tissue as "pro-life." For further discussion, see Dolgin, *supra* note 1.

stem cell research can develop as an alternative to animal testing and research and be used to improve the health of nonhuman animals themselves, it is an option animal advocates should seriously consider given the proper regulatory environment. In the United States alone, more than a million animals (not including mice, rats, and non-mammals, which are not protected by the Animal Welfare Act[147]) are used in research per year.[148] In addition, in 1988 the U.S. National Association for Biomedical Research (NABR) "estimate[d] that 23 million rats and mice were used."[149] Developing alternatives to animal research would thus have a substantial impact on animal flourishing by reducing the numbers of animals subjected to such research, assuming the success of convincing researchers who have traditionally relied on animal research that human embryos and human cells are adequate research models. The discoveries that emerge from this animal-free research could then conceivably be used to improve animal therapies as well. In these ways, laboratory animals might finally be treated as true "agents of their own history."[150] These are therefore critical reasons for animal advocates to remain open to animal-free stem cell research.

In this Part, we have sought to generate parameters for a discussion of how animal advocates should intervene in the stem cell debate. The adoption of a deontological framework for animals requires opposition to animal-reliant stem cell research. The response to potential animal-free stem cell research, which may dominate in the future, is less clear. We have identified several factors that should inform this emergent discussion. To summarize: We have explained why the parallel often drawn between human embryos and animals in ethical discussions is misguided and thus should not preclude animal advocates from supporting stem cell research. There are, on the other hand, legitimate concerns raised by feminists, disability advocates, and those concerned with growing global disparities and with the influence of biopolitics. Countering the force of these arguments, however, is the prospect of stem cell research reducing

147. Animal Welfare Act, 7 U.S.C. §§ 2131-2159 (2007). The *Animal Welfare Act* defines "animal" as "any live or dead dog, cat, monkey (nonhuman primate mammal), guinea pig, hamster, rabbit, or such other warm-blooded animal, as the Secretary [of Agriculture] may determine is being used, or is intended for use, for research, testing, experimentation, or exhibition purpose, or as a pet [with some other exclusions]." 7 U.S.C. § 2132(g) (2007).

148. U.S. DEP'T OF AGRIC., ANIMAL WELFARE ACT REPORT 2006, at 2 (2007), *available at* http://www.aphis.usda.gov/animal_welfare/downloads/awreports/awreport2006.pdf (In 2006, the Department of Agriculture listed 66,314 dogs, 21,637 cats, 62,315 non-human primates, 204,809 guinea pigs, 167,571 hamsters, 239,720 rabbits, 57,571 pigs, 13,577 sheep, 34,632 other farm animals, and 144,567 other mammals—a total of 1,012,713 animals—as subjects of scientific research).

149. Frankie L. Trull & Barbara A. Rich, *More Regulation of Rodents*, 284 SCIENCE 1463, 1463 (1999).

150. Lynda Birke, Mette Bryld & Nina Lykke, *Animal Performances: An Exploration of Intersections Between Feminist Science Studies and Studies of Human/Animal Relationships*, 5 FEMINIST THEORY 167, 172 (2004).

the incidence of animal research and improving therapeutic treatments for animals. A decisive answer about the position animal advocates should take on the stem cell research debate would require more space to develop. This Part has nonetheless helped to generate future discussion by canvassing important ingredients within it.

Conclusion

It is often assumed that there is a singular debate regarding embryonic stem cell research, one that revolves around the human embryo's claim to humanness or personhood. The magnitude of this debate prevents other dimensions of the ethics of embryonic stem cell research from surfacing in mainstream consciousness. One of these dimensions is the connections embryonic stem cell research has with animal research both historically and in the present day. Stem cell research originated through the use of animals and is still reliant on animal bodies for its development. In this regard, embryonic stem cell research is not so different from other medical research. Even beyond the actual use of animals and their bodies, policymakers have highlighted the advancement of animal-based industries as a further reason to pursue embryonic stem cell research. They present the potential commercial benefits of making faster or better animals for animal-exploitative industries beside human health-based reasons in arguing that embryonic stem cell research is an ethical activity.

In the midst of the ongoing main debate that centers on the status of the human embryo, many jurisdictions have legislated with respect to embryo research with varying levels of restrictions. Despite the scientific and political intimacy between animal research and embryonic stem cell research, animal advocates have not entered into the discussions leading up to or following after these enactments in any substantial way. This is a gap in animal advocacy that needs to be filled. From a deontological view, the reliance of stem cell research on animal research is of serious concern, sufficient to quell any support for this "new" medical practice. But there is nothing inherently essential about the use of animals in embryonic stem cell research. If the trajectory of stem cell research shifted to exclude animals, such that it was possible and became routine to conduct embryonic stem cell research without them, then the possibilities that such research might replace animal research would warrant, at the very least, further attention from those who care about the injustices suffered by animals. In saying this, our intention here is not to catapult lobbying for animal-free stem cell research to the top of the animal advocacy agenda. There are many other campaigns to be advanced and launched which arguably should be prioritized to end animal suffering. And it is worth repeating that there are likely more effective and egalitarian ways to improve human and animal health

internationally than pouring billions of dollars into stem cell research.[151] Moreover, the related distributional concerns raised by the current era of biopolitics should not be minimized. Whether or not the likelihood of reducing animal research is enough to outweigh these progressive reasons requires further discussion than space permits here. What we have highlighted in this paper are the main factors that, it is hoped, will prompt animal advocates to consider and assess the ethics and desirability of animal-free stem cell research and thus enter the national and international debates in this realm.

151. California has proposed to establish the California Institute for Regenerative Medicine and spend $3 billion on stem cell research over 10 years, although the money has been held up by litigation. Andrew Polack, *California Stem Cell Program on Fast Track*, N.Y. TIMES, Jan. 11, 2005, at A16. Elsewhere, New York has proposed to spend $1 billion, Massachusetts $1.25 billion, and New Jersey $270 million on stem cell research. Pam Belluck, *Massachusetts Proposes Stem Cell Research Grants*, N.Y. TIMES, May 9, 2007, at A17.