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Cloning Endangered Animal Species?

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Legal Perspectives on Cloning

CLONING ENDANGERED ANIMAL SPECIES?

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I. INTRODUCTION

Hello Dolly! Well hello Dolly! It's so nice to have you back where you belong. You're looking swell Dolly. We can tell Dolly. You're still glow-in you're still grow-in, you're still go-in strong.[1]

Underlying the beauty of the spectacle there is meaning and significance. It is the elusiveness of that meaning that haunts us, that sends us again and again into the natural world where the key to the riddle is hidden.[2]

In the year 2101, when historians start to write the history of the twenty-first century,[3] they may be tempted to herald its beginning on February 23, 1997. On that date, the *New York Times* ran the following front-page headline about the successful whole-organism (or whole-body) cloning (as distinguished from cloning of selected genes from a donor organism) of Lamb Number 6LL3, better known as Dolly: *Feat Is Shock to Experts*.[4] As whimsically explained

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* B.S., University of Pennsylvania (Wharton School), 1973; J.D., Cornell Law School, 1977; Professor of Law, Valparaiso University School of Law. This article is lovingly dedicated to my 12-year-old daughter, Courtney Patricia Blomquist, who inspired the idea for my article during the course of an enchanting father-daughter discussion about animals. My thanks and appreciation to my research assistant, Gary Selig, for his excellent insight, judgment, and research.

1. READER'S DIGEST, THE EASY WAY TO PLAY SONGBOOK 70 (1991) (words and music by Jerry Herman).

2. DOUGLAS H. CHADWICK & JOEL SARTORE, THE COMPANY WE KEEP: AMERICA'S ENDANGERED SPECIES 8 (1996) (quote by Rachel Carson).

3. Historians may not necessarily wait until the end of the 21st century. By way of comparison, see ERIC HOBSBAWM, THE AGE OF EXTREMES: A HISTORY OF THE WORLD, 1914-1991 (1994) (dividing the 20th century into the Age of Catastrophe, 1914-1945; the Golden Age, 1947-1973; and the Landslide, 1973-1991; and referring to his construct as the "*Short Twentieth Century*"). In comparison, in his previous writings, Hobsbawm discussed the "long nineteenth century" (from the 1780s to 1914).

4. Gina Kolata, *Scientist Reports First Cloning Ever of Adult Mammal: Feat Is Shock to Experts*, N.Y. TIMES, Feb. 23, 1997, § 1, at 6.

by Professor Philip Kitcher in his recent book, *The Lives to Come: The Genetic Revolution and Human Possibilities*:

> Dolly, took the world by surprise, sparking debate about the proper uses of biotechnology and inspiring predictable public fantasies (and predictable jokes). Recognizing that what is possible today with sheep will probably be feasible with human beings tomorrow, commentators speculated about the legitimacy of cloning Pavarotti or Einstein, about the chances that a demented dictator might produce an army of supersoldiers, and about the future of basketball in a world where the Boston Larry Birds play against the Chicago Michael Jordans. Polls showed that Mother Teresa was the most popular choice for person-to-be cloned, although a film star (Michelle Pfeiffer) was not far behind . . . .[5]

The significance of Dolly and her three mothers[6] can best be put in context by viewing them as embodying a significant enhancement in cloning technology, which is subsumed by the broader category, *biomolecular revolution*—one of three overarching scientific revolutions that have profoundly shaped the twentieth century. Indeed, these three scientific revolutions have been predicted to transform the way we will live in the twenty-first century. The other two key scientific revolutions are the *computer revolution* and the *quantum revolution*. Professor Michio Kaku, a research physicist, provides the following synopsis of these three critical and interrelated scientific revolutions:

> Matter. Life. The Mind.
>
> These three elements form the pillars of modern science. Historians will most likely record that the crowning achievement of twentieth-century science was unraveling the basic components underlying these three pillars, culminating in the splitting of the nucleus of the atom,

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5. PHILIP KITCHER, THE LIVES TO COME: THE GENETIC REVOLUTION AND HUMAN POSSIBILITIES 327 (1996).

6. Kitcher explained:

> Dolly has the same nuclear genetic material as the adult pregnant ewe, from whose udder cell the inserted nucleus originally came. A different female supplied the egg into which the nucleus was inserted, and Dolly thus has the same mitochondrial DNA as this ewe; indeed her early development was shaped by the interaction between the DNA in the nucleus and the contents of the cytoplasm, the contributions of different adult females. Yet a third sheep, the ewe into which the embryonic Dolly was implanted, played a role in Dolly's nascent life, providing her with a uterine environment. In an obvious sense, Dolly has three mothers—nucleus mother, egg mother, and womb mother—and no father . . . .

Id. at 330.

> the decoding of the nucleus of the cell, and the development of the electronic computer. With our basic understanding of matter and life largely complete, we are witnessing the close of one of the great chapters in the history of science. . . .

The first of these twentieth-century revolutions was the *quantum revolution*, the most fundamental of all. The quantum revolution later helped to spawn the two other great scientific revolutions: the *biomolecular revolution* and the *computer revolution*.[7]

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7. MICHIO KAKU, VISIONS: HOW SCIENCE WILL REVOLUTIONIZE THE 21ST CENTURY 7 (1997). Professor Kaku goes on to sketch a brief history and possible future role for these three scientific revolutions. His description is worthy of extensive quotation:

> *The Quantum Revolution*
>
> Since time immemorial, people have speculated what the world was made of. The Greeks thought that the universe was made of four elements: water, air, earth, and fire. The philosopher Democritus believed that even these could be broken down into smaller units, what he called "atoms." But attempts to explain how atoms could create the vast, wondrous diversity of matter we see in Nature always faltered. Even Newton, who discovered the cosmic laws which guided the motion of planets and moons, was at a loss to explain the bewildering nature of matter.
>
> All this changed in 1925 with the birth of the quantum theory, which has unleashed a thundering tidal wave of scientific discovery that continues to surge unabated to this day. The quantum revolution has now given us an almost complete description of matter, allowing us to describe the seemingly infinite multiplicity of matter we see arranged around us in terms of a handful of particles, in the same way that a richly decorated tapestry is woven from a few colored strands.
>
> . . . .
>
> In the twentieth century, the quantum theory has given us the ability to understand the matter we see around us. In the next century, the quantum revolution may open the door to the next step: *the ability to manipulate and choreograph new forms of matter, almost at will.*
>
> *The Computer Revolution*
>
> In the past, computers were mathematical curiosities; they were supremely clumsy, messy contraptions, consisting of a complex mass of gears, levers, and cogs. During World War II, mechanical computers were replaced by vacuum tubes, but they were also monstrous in size, filling up entire rooms with racks of thousands of vacuum tubes.
>
> The turning point came in 1948, when scientists at Bell Laboratories discovered the transistor, which made possible the modern computer.
>
> . . . .
>
> Today, tens of millions of transistors can be crammed into an area the size of a fingernail. In the future, our lifestyles will be irrevocably changed when microchips become so plentiful that intelligent systems are dispersed by the millions into all parts of our environment.
>
> In the past, we could only marvel at the precious phenomenon called intelligence; *in the future, we will be able to manipulate it according to our wishes.*
>
> *The Biomolecular Revolution*
>
> Historically, many biologists were influenced by the theory of "vitalism"—i.e., that a mysterious "life force" or substance animated living things. This view was challenged when [Erwin] Schrödinger, in his 1944 book *What is Life?*, dared to claim that life

Professor Kaku—a technological optimist with an unshakable belief in the idea of progress[8]—posits that the twentieth century achievements of the biomolecular revolution will set the stage for further radical scientific change during the twenty-first century: "*Instead of watching the dance of life, the biomolecular revolution will ultimately give us the nearly godlike ability to manipulate life almost at will.*"[9] In Kaku's words, humanity has the prospect within the foreseeable future to move from its passive bystander status to an active choreographer of nature status.[10] But exactly what does this mean?

> could be explained by a "genetic code" written on the molecules within a cell. It was a bold idea: that the secret of life could be explained by using the quantum theory.
>
> James Watson and Francis Crick, inspired by Schrödinger's book, eventually proved his conjecture by using X-ray crystallography. By analyzing the patterns of X-rays scattered off a DNA molecule, they were able to reconstruct the detailed atomic structure of DNA and identify its double-helical nature. Since the quantum theory also gives us the precise bonding angles and bonding strength between atoms, it enables us to determine the position of practically all the individual molecules in the genetic code of a complex virus like HIV.

Id. at 7-9 (emphasis added).

8. The idea of progress has a fascinating intellectual history. While the idea of progress has implicit antecedents in ancient and medieval thought, its explicit formulation is modern, stemming from the Age of Enlightenment during the seventeenth and eighteenth centuries. Modern philosophers of history such as Vico, Condorcet, Kant, Proudhon, Comte, J.S. Mill, Hegel and Marx expressed optimism in their writings regarding the perfectibility of human beings; alternatively, they perceived "forces of history—whether the manifestations of a world spirit or the pressure of material (i.e. economic) conditions—an inevitable development from less to more advanced stages of civilization, according to a dialectical pattern of conflict and resolution, each resolution necessarily rising to a higher level." 2 THE GREAT IDEAS: A SYNTOPICON OF GREAT BOOKS OF THE WESTERN WORLD 438 (Mortimer J. Adler ed., 1984) [hereinafter SYNTOPICON].

9. KAKU, *supra* note 7, at 9 (emphasis added).

10. *Id.* According to Professor Kaku, during the twenty-first century, humanity will "make the transition from unraveling the secrets of Nature to becoming *masters of Nature*." *Id.* at 10 (emphasis added). As a result of synthesizing interviews with over 150 scientists—several of them Nobel laureates—Professor Kaku reveals what he terms a growing consensus among the world's leading scientists about how science will evolve through the early, middle, and late years of the twenty-first century. Worthy of extensive quotation, Kaku predicts the following developments within the biomolecular, computer, and quantum scientific revolutions:

> *To the Year 2020*
>
> From now to the year 2020, scientists foresee an explosion in scientific activity such as the world has never seen before. In two key technologies, computer power and DNA sequencing, we will see entire industries rise and fall on the basis of breathtaking scientific advances. Since the 1950s, the power of our computers has advanced by a factor of roughly *ten billion*. In fact, because both computer power and DNA sequencing double roughly every two years, one can compute the rough time frame over which many scientific breakthroughs will take place. This means that predictions about the future of computers and biotechnology can be quantified with reasonable statistical accuracy through the year 2020.
>
> For computers, this staggering growth rate is quantified by Moore's law, which states that computer power doubles roughly every eighteen months. . . . Moore's law, in turn, determines the fate of multibillion-dollar computer corporations, which base

their future projections and product lines on the expectation of continued growth. By 2020, microprocessors will likely be as cheap and plentiful as scrap paper, scattered by the millions into the environment, allowing us to place intelligent systems everywhere. This will change everything around us, including the nature of commerce, the wealth of nations, and the way we communicate, work, play, and live. This will give us smart homes, cars, TVs, clothes, jewelry, and money. We will speak to our appliances, and they will speak back. . . .

Because of revolutionary advances in our ability to etch ever-smaller transistors into silicon wafers, scientists expect this relentless drive to continue to generate newer and more powerful computers up to 2020, when the iron laws of quantum physics eventually take over once again. By then, the size of microchip components will be so small—roughly on the scale of molecules—that quantum effects will necessarily dominate and the fabled Age of Silicon will end.

The growth curve of biotechnology will be equally spectacular in this period. In biomolecular research, what is driving the remarkable ability to decode the secret of life is the introduction of computers and robots to automate the process of DNA sequencing. This process will continue unabated until roughly 2020, until literally thousands of organisms will have their complete DNA code unraveled. By then, it may be possible for anyone on earth to have their personal DNA code stored on a CD. We will then have the Encyclopedia of Life.

This will have profound implications for biology and medicine. Many genetic diseases will be eliminated by injecting people's cells with the correct gene. Because cancer is now being revealed to be a series of genetic mutations, large classes of cancers may be curable at last, without invasive surgery or chemotherapy. Similarly, many of the microorganisms involved in infectious diseases will be conquered in virtual reality by locating the molecular weak spots in their armor and creating agents to attack these weak spots. Our molecular knowledge of cell development will be so advanced that we will be able to grow entire organs in the laboratory, including livers and kidneys.

From 2020 to 2050

The prediction of explosive growth of computer power and DNA sequencing from now through 2020 is somewhat deceptive, in that both are driven by known technologies. Computer power is driven by packing more and more transistors onto microprocessors, while DNA sequencing is driven by computerization. Obviously, these technologies cannot indefinitely continue to grow exponentially. Sooner or later, a bottleneck will be hit.

By around 2020, both will encounter large obstacles. Because of the limits of silicon chip technology, eventually we will be forced to invent new technologies whose potentials are largely unexplored and untested, from optical computers, molecular computers, and DNA computers to quantum computers. Radically new designs must be developed, based on the quantum theory, which will likely disrupt progress in computer science. Eventually the reign of the microprocessor will end, and new types of quantum devices will take over.

If these difficulties in computer technology can be overcome, then the period 2020 to 2050 may mark the entrance into the marketplace of an entirely new kind of technology: true robot automatons that have common sense, can understand human language, can recognize and manipulate objects in their environment, and can learn from their mistakes. It is a development that will likely alter our relationship with machines forever.

Similarly, biotechnology will face a new set of problems by 2020. The field will be flooded with millions upon millions of genes whose basic functions are largely unknown. Even before 2020, the focus will shift away from DNA sequencing to

What further technological developments are probable? Regardless of what biomolecular technologies are possible, what normative limits, if any, should restrict the Promethean Project of striving to be "choreographers of nature"?

The purposes and functional structure of this Article are threefold. In Part II, by way of background, I will briefly describe emerging biomolecular technologies (including whole-organism cloning) which may become feasible during the next 100 years. In Part III, by way of further background, I will compare and contrast the concept of human whole-organism cloning with the concept of non-human species whole-organism cloning of animals by synoptically considering five overarching and interconnected philosophical issues. In Part IV, I will explore the legal, policy, and ethical implications of

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understanding the basic functions of these genes, a process which cannot be computerized, and to understand polygenic diseases and traits—i.e. those involving the complex interaction of multiple genes. The shift to polygenic diseases may prove to be the key to solving some of the most pressing chronic diseases facing humanity, including heart disease, arthritis, autoimmune diseases, schizophrenia, and the like. *It may also lead to cloning humans and to isolating the fabled "age genes" which control our aging process, allowing us to extend the human life span.*

Beyond 2020, we also expect some amazing new technologies germinating in physics laboratories to come to fruition, from a new generation of lasers and holographic three-dimensional TV to nuclear fusion. Room-temperature superconductors may find commercial applications and generate a "second industrial revolution." The quantum theory will give us the ability to manufacture machines the size of molecules, thereby opening up an entirely new class of machines with unheard-of properties called nanotechnology. Eventually, we may be able to build ionic rocket engines that may ultimately make interplanetary travel commonplace.

From 2050 to 2100 and Beyond

. . . Although any predictions this far into the future are necessarily vague, it is a period that will likely be dominated by several new developments. Robots may gradually attain a degree of "self-awareness" and consciousness of their own. This could greatly increase their utility in society, as they are able to make independent decisions and act as secretaries, butlers, assistants, and aides. Similarly, the DNA revolution will have advanced to the point where biogeneticists are able to create *new types of organisms* involving the transfer of not just a few but even hundreds of genes, allowing us to increase our food supply and improve our medicines and our health. It may also give us the ability to design new life forms and to orchestrate the physical and perhaps even the mental makeup of our children, which raises a host of ethical questions.

The quantum theory, too, will exert a powerful influence in the next century, especially in the area of energy production. We may also see the beginnings of rockets that can reach the nearby stars and plans to form the first colonies in space.

Beyond 2100, some scientists see a further convergence of all three revolutions, as the quantum theory gives us transistor circuits and entire machines the size of molecules, allowing us to duplicate the neural patterns of the brain on a computer. In this era, some scientists have given serious thought to extending life by growing new organs and bodies, by manipulating our genetic makeup, or even by *ultimately merging with our computerized creations.*

Id. at 14-17 (emphasis added).

a possible American government policy that aggressively encourages the cloning of endangered animal species.

II. PLAYING GOD: EMERGING BIOMOLECULAR TECHNOLOGIES OF THE TWENTY-FIRST CENTURY

A. *What Is Past Is Prologue*

Current biomolecular technologies, also known as genetic engineering or genetic manipulation,[11] are premised on the belief "that genetic information,

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11. The current state-of-the-art of biomolecular technologies finds its roots in the science of genetics. Genetics "began with the rediscovery of Gregor Mendel's [classic] work at the turn of the [twentieth] century, and the next 40 years or so saw the elucidation of the principles of inheritance and genetic mapping." DESMOND S.T. NICHOLL, AN INTRODUCTION TO GENETIC ENGINEERING 3 (1994). After World War II microbial genetics emerged as a separate area of scientific study. During the approximately 50 years of development of this branch of genetic study "great advances were made in understanding the mechanisms of gene transfer between bacteria, and a broad knowledge base was established from which later development would emerge." *Id.* With James Watson's and Francis Crick's discovery in 1953 of DNA (deoxyribonucleic acid), the branch of molecular genetics emerged during the 1950s and early 1960s when "the main features of the gene and its expression were determined. The work culminated with the establishment of the complete genetic code in 1966 [and] the stage was now set for the appearance of the *new genetics*." *Id.* (emphasis added).

> In the late 1960s there was a sense of frustration among scientists working in the field of molecular biology. Research had developed to the point where progress was being hampered by technical constraints, as the elegant experiments that had helped to decipher the genetic code could not be extended to investigate the gene in more detail. However, a number of developments provided the necessary stimulus for a gene manipulation to become a reality. In 1967 the enzyme *DNA ligase* was isolated. This enzyme can join two strands of DNA together, a prerequisite for the construction of recombinant molecules, and can be regarded as a sort of molecular glue. This was followed by the isolation of the first *restriction enzyme* in 1970, a major milestone in the development of genetic engineering. Restriction enzymes are essentially molecular scissors, which cut DNA at precisely defined sequences. Such enzymes can be used to produce fragments of DNA that are suitable for joining two other fragments. Thus, by 1970, the basic tools required for the construction of recombinant DNA were available.
>
> The first recombinant DNA molecules were generated at Stanford University in 1972, utilising the cleavage properties of restriction enzymes (scissors) and the ability of DNA ligase to join DNA strands together (glue). The importance of these first tentative experiments cannot be overestimated. Scientists could now join different DNA molecules together, and could link the DNA of one organism to that of a completely different organism. The methodology was extended in 1973 by joining DNA fragments to the plasmid pSC101 which is an *extrachromosomal element* isolated from the bacterium *Escherichia coli*. These recombinant molecules behaved as *replicons*, i.e. they could replicate when introduced into *E. coli* cells. Thus, by creating recombinant molecules *in vitro*, and placing the construct in a bacterial cell when it could replicate *in vivo*, specific fragments of DNA could be isolated from bacterial colonies that formed clones (colonies formed from a single cell, in which all cells are identical) when grown on agar plates. This development marked the emergence of the technology which

encoded by DNA and arranged in the form of genes, is a resource which can be manipulated in various ways to achieve certain goals in both pure and applied science and medicine."[12] As of the late twentieth century, genetic manipulation was socially useful in three main areas: (1) basic research on gene functions and structures; (2) efficient and effective production of useful proteins; and (3) creation of transgenetic plants and animals.[13] At present, the mainstay of biomolecular technologies

> is the ability to isolate a single DNA sequence from the genome. This is the essence of *gene cloning*, and can be considered as a series of four steps. Successful completion of these steps provides the genetic engineer with a specific DNA sequence, which may then be used for a variety of purposes. A useful analogy is to consider gene cloning as a form of *molecular agriculture*, enabling the production of large amounts (in genetic engineering this means micrograms or milligrams) of a particular DNA sequence.[14]

> became known as *gene cloning*.
>
> The discoveries of 1972 and 1973 triggered off what is perhaps the biggest scientific revolution of all—the new genetics. The use of the new technology spread very quickly, and a sense of urgency and excitement prevailed. This was dampened somewhat by the realisation that the new technology could give rise to potentially harmful organisms, exhibiting undesirable characteristics. It is to the credit of the biological community that measures were adopted to regulate the use of gene manipulation, and that progress in contentious areas was limited until more information became available regarding the possible consequences of the inadvertent release of organisms containing recombinant DNA.

Id. at 4-5 (citations to figures omitted). *See also* DAVID SUZUKI & PETER KNUDTSON, GENETHICS: THE CLASH BETWEEN THE NEW GENETICS AND HUMAN VALUES 96-102 (1990) (providing a brief history of recombinant DNA technologies).

12. NICHOLL, *supra* note 11, at 1-2.

13. *Id.* at 2.

14. *Id.* (citations to figures omitted). The four basic steps of gene cloning involve the following: first, "generation of DNA fragments"; second, "joining to a vector or carrier molecule"; third, "introduction into a host cell for amplification"; and fourth, "selection of required sequence." *Id.* (Fig. 1.1). DNA is the "gene-bearing double helix molecule, made of linked nucleotide subunits, that is the primary hereditary molecule in most species." SUZUKI & KNUDTSON, *supra* note 11, at 342. Other important DNA-linked concepts are *DNA ligase* ("An enzyme that can rejoin nucleotides in a DNA strand."); *DNA polymerase* ("An enzyme that can synthesize a new DNA strand using an existing DNA strand as a template."); *DNA polymorphism* ("The occurrence, in a population, of multiple alternative DNA sequences at a particular gene site."); *DNA sequencing* ("The process of deciphering the precise order of nucleotide bases in a DNA molecule."). *Id.*

The 1997 whole-body cloning of Dolly,[15] however, significantly extends past gene-cloning technologies to encompass potential genetic replication of an entire organism.[16] This development adds to the current theoretical inventory of what Judge Richard A. Posner refers to, in the human context, as "separating sex from reproduction."[17]

B. Back to the Future

According to Professor Kaku's recent book,[18] a veritable *biomolecular revolution* will take place during the twenty-first century that will vastly expand humans' technological ability to manipulate life. According to a consensus assessment by leading world scientists,[19] Kaku predicts the following biomolecular breakthroughs over the next 100 years:

1. The Emergence of Hereditary Disease Codes

By the year 2000, "scientists will have deciphered the genetic codes for twenty to fifty hereditary diseases which have caused untold suffering since the dawn of humanity, including cystic fibrosis, muscular dystrophy, sickle-cell anemia, Tay-Sachs disease, hemophilia, and Huntington's Chorea."[20]

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15. *See supra* notes 1-6 and accompanying text.

16. In the weeks after the cloning of Dolly, "it seemed that [whole organism] cloning all kinds of animals was just around the corner; from the middle 1980s to 1996, it appeared that cloning adult mammals was a science-fiction" dream. "However, unless there is some quite unanticipated snag, we can expect that [the Dolly] technique will eventually work just as well on human cells as it does in sheep, and that the failure rates in sheep (or in other mammals) will quickly be reduced." KITCHER, *supra* note 5, at 330 (emphasis omitted). *See generally infra* note 28 and accompanying text (discussing, among other things, the projection that whole organism cloning of human beings will be done sometime by the year 2005).

17. RICHARD A. POSNER, SEX AND REASON 405 (1992). In the human context, according to Posner, a non-technological institution separating reproduction from sex was, and continues to be, adoption. *Id.* at 405-20. Current technological techniques for separating human reproduction from sex include artificial insemination, surrogate motherhood, and eugenics (although Posner describes the political unpopularity of eugenics at this time). *Id.* at 420-34. Posner views whole organism human cloning, "if it ever develops to the point where a human being can be duplicated" as fitting within his categorization of separating reproduction from sex. *Id.* at 425. Posner's purpose in pursuing this analysis is to explore the "profound implications for sexual attitudes, customs, and regulations." *Id.* at 405.

18. *See supra* note 7 and accompanying text.

19. KAKU, *supra* note 7, at 5-6 (describing "emerging consensus among scientists" of scientific predictions over the next 100 years).

20. *Id.* at 143.

2. A Complete Genetic Code for Humanity

By the year 2005, the approximately 100,000 genes that comprise the human genome "will have been deciphered by the Human Genome Project, which will open up the secrets locked for millions of years in our genes. For the first time, scientists will be able to view the complete genetic code of humanity."[21]

3. Vast Expansion of Hereditary Disease Codes

No later than 2010, "genetic profiles of [human] hereditary diseases will balloon to approximately 2,000 to 5,000, giving us an almost complete understanding of the genetic basis of these ancient diseases."[22]

4. The Reality of Personal Disease Codes

By the year 2020, personalized disease codes, with an individual's entire DNA sequence on a CD, may be available.[23] This will allow physicians to predict the probability of a person contracting a disease before it occurs. This, in turn, will move medicine from a treatment-based discipline to a prevention-based discipline.[24]

5. Life Span Extension and Organ Duplication

Between 2020 and 2050, science will likely isolate mammalian age genes in various species and ultimately in human beings, allowing human life spans to extend to around 150 years of age.[25] Moreover, it is expected that during this same timeframe technology will develop to grow "new organs in [a human] body to replace worn-out organs"—replicating the natural ability of other animals like lizards and amphibians to regenerate lost limbs or tails.[26]

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21. *Id.*

22. *Id.*

23. *Id.* "This CD will be the crowning achievements of billions of dollars of research, the product of hundreds of dedicated scientists working to write the 'encyclopedia of life,' which will include *everything necessary (in principle) to construct ourselves*. Once it is completed, we will have an 'owner's manual' for a human being." *Id.* (emphasis added).

24. *Id.* at 145.

25. *Id.* at 214.

26. *Id.* at 217. "From the period 2020 to 2050, we may expect more complex organisms and body parts [for human beings and animals] to be duplicated in the laboratory. These include, for example, hands, hearts, and other complex internal organs. Beyond 2050, perhaps every organ in the body will be replaceable, except the brain." *Id.* at 219.

6. Creating and Manipulating New Life Forms

Professor Kaku continues, suggesting that "[f]rom now to 2020, the pace of creating transgenic animals [and plants] [i.e., organisms produced by the transfer and expression of genes from another species] will vastly accelerate because we will have the complete genome of thousands of life forms on earth to guide us."[27] Moreover, whole-organism cloning technology will likely evolve from now until 2005 and beyond, from the present know-how regarding plant cloning and sheep cloning to advanced techniques of cloning other higher-level animals and, by one projection, the first human clone.[28] Ultimately, by

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27. *Id.* at 223. Professor Kaku also noted:

> So far, most successful gene transfers have involved injecting a single gene which produces a single enzyme from one animal or plant into another. . . .
>
> This simple process has created valuable, life-saving hormones and chemicals, by clipping certain human genes with restriction enzymes and injecting the genes into bacteria. Since 1978, insulin, once available only from the pancreas of pigs, has been produced by injecting the human gene for insulin into *E. coli* bacteria. In a process somewhat like that of fermentation, which produces alcohol, these modified *E. coli* can produce unlimited quantities of human insulin. Four million diabetics depend on this crucial process.
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> . . . .
>
> This is, in fact, one of the great successes of the biomolecular revolution. From now through 2020, when personalized DNA sequencing becomes possible, virtually all the exotic hormones and enzymes found in the body may be reproducible in quantities by inserting the human gene for that chemical into bacteria and allowing it to "ferment."
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> . . . .
>
> Progress in developing transgenetic animals will also accelerate through 2020. The first breakthrough in creating transgenetic mammals occurred in 1976 when scientists at the Fox Chase Cancer Institute in Philadelphia created a new form of mice by injecting a leukemia virus into embryonic mice cells. The technique was further refined in 1980 with the development of "microinjection." First, fifteen to twenty newly fertilized eggs were removed from a female mouse. Under a microscope, a technician manipulated a joystick that controlled an extremely thin, hairlike glass tube, which contained minute quantities of a foreign gene. The glass tube pricked the eggs and injected the foreign gene into the fertilized eggs under a microscope. The eggs were then inserted into a surrogate mouse, which delivered pups twenty days later. Analyses of the pups confirmed that their mice genome was permanently altered.
>
> Since then, microinjection has been used successfully on rabbits, pigs, goats, sheep, and cows to produce a variety of transgenetic animals. . . .

Id. at 223-24. Moreover, from now until 2020, we should see better progress in enhanced technologies for food crops, genetically-engineered pesticide-producing plants, disease-resistant plants, herbicide-resistant plants and valuable drug-producing plants. *Id.* at 224-25.

28. *Id.* at 225-27. Kaku explained:

> In principle, cloning of higher organisms can be performed in two ways. The first is to remove cells from an embryo (before they have differentiated into cells for skin, muscle neurons, and so on), alter them and culture them in a laboratory or insert them into a surrogate mother. The second method is far more difficult and interesting, taking mature cells which have already differentiated and somehow coaxing them to revert back to their embryonic state. Until recently, it was believed to be impossible to clone an

the year 2100, science may very well allow the creation of "designer lifeforms" (including humans) with "desirable" aesthetic and functional attributes (e.g., body shape, behavior, etc.). This development could encompass "metahumans" or a new human species of "homo superior."[29]

III. THE BROAD PHILOSOPHICAL CONCEPT OF WHOLE-ORGANISM CLONING: HUMAN ANIMALS VERSUS NON-HUMAN ANIMALS

A. Overview

The broad philosophical framework for whole-organism cloning of human and non-human animals is shaped by five overarching issues: (1) the distinction between human and non-human animal nature;[30] (2) continuity and discontinuity in the scale of animal life (i.e., gradations from lower to higher forms);[31] (3) the use and abuse of non-human animals by humans;[32] (4) the

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adult mammal.

> In principle, mature cells contain all the DNA necessary to create an entire organism, but scientists had been unable to get these differentiated cells to revert back to their embryonic state. For over a decade, scientists abandoned hope that they could coax a skin cell, say, to *regenerate an entire animal.*
>
> *All this changed with the work of Ian Wilmut of the Roslin Institute outside Edinburgh, Scotland.* The world was unprepared for his announcement in 1997 that he successfully *completed the second method, the cloning of a sheep of an adult cell, by extracting a cell from the mammary gland of an adult sheep. After 277 unsuccessful tries, Wilmut's team produced the world's first cloned mammal of an adult sheep, which they called Dolly.* "Not since God took Adam's rib and fashioned a helpmate for him has anything so fantastic occurred," hailed *Newsweek.*
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> . . . .
>
> Numerous hurdles still exist. The [Dolly] experiment has yet to be duplicated in other laboratories. In addition, Dolly's cells, cloned from a six-year-old adult, may show signs of premature aging. Genetic damage is also a distinct possibility in cloning. More important, the precise mechanism that makes cells "remember" long-forgotten genes still has to be elucidated.
>
> Ron James of PPL Therapeutics, which provided . . . funding for [the Dolly Project], says that practical applications include creating herds of sheep which produce milk laced with beneficial enzymes and drugs. But when asked how long it will be before this technique is used to clone humans, he replied, "Hopefully, an eternity."
>
> It's always difficult to make the leap from animals to humans, but bioethicist Arthur Caplan *foresees the first human clone within seven years [by the year 2005].* Even if human cloning is banned, it is possible that an underground cloning industry may develop over time.

Id. at 226-27 (emphasis added).

29. *Id.* at 227-40.

30. *See infra* notes 36-46 and accompanying text.

31. *See infra* notes 47-54 and accompanying text.

32. *See infra* notes 55-60 and accompanying text.

ontology, or being, of cloned (non-sexually reproduced) animals versus sexually reproduced animals;[33] and (5) the intended and unintended consequences of human attempts to control nature through technology.[34]

This Part of my Article will approach the emerging technology of whole-organism cloning from a synoptical, big-picture perspective. After examining the substance of the five aforementioned philosophical issues, I will, in the final Part of my Article, apply and amplify these general insights to a hypothetical future American environmental policy of encouraging the cloning of endangered animals under the Endangered Species Act and its possible statutory successors.[35]

B. Five Overarching Philosophical Issues Bearing on Whole-Organism Cloning

1. Human Versus Non-Human Animal Nature

In *Hamlet*, Shakespeare has the Prince of Denmark reflect on the multifarious human conception of what the true quality of human nature might be: "What a piece of work is a man! how noble in reason! how infinite in faculty! in form and moving how express and admirable! in action how like an angel! in apprehension how like a god! the beauty of the world! the paragon of animals!"[36] Indeed, human beings have, at various historical moments, tended to identify themselves with animals, angels, or gods.

> Yet predominantly [humans have] regarded [themselves] as . . . animal[s], even when [they have] understood [themselves] to be created in God's image, and to share with the angels, through the possession of intellect, the dignity of being . . . person[s]. As [humans'] understanding of [themselves] has varied, so ha[ve] [they] altered [their] conception of what it is to be an animal.[37]

Surprisingly, at times, as exemplified in Montaigne's *Essays* and Swift's *Gulliver's Travels*, humans have viewed themselves as less worthy and less noble than beasts.[38] Other intellectual perspectives link human and animal

33. *See infra* notes 61-66 and accompanying text.

34. *See infra* notes 67-83 and accompanying text.

35. *See infra* notes 84-138 and accompanying text.

36. WILLIAM SHAKESPEARE, HAMLET act 2, sc. 2.

37. 1 SYNTOPICON, *supra* note 8, at 19. My initial reference to *Hamlet* in the text accompanying note 36, *supra*, comes from this source.

38. *See, e.g.*, MICHEL EYQUEM DE MONTAIGNE, THE ESSAYS, *in* 25 GREAT BOOKS OF THE WESTERN WORLD 216 (Robert Maynard Hutchins ed., 1984) ("their [animals'] brutish stupidity surpasses in all conveniences all that our divine intelligence can do"); JONATHON SWIFT, GULLIVER'S TRAVELS, *in* 36 GREAT BOOKS OF THE WESTERN WORLD 138 (Robert Maynard

existence in egalitarian parlance through allegories of fable and poetry. "From Aesop to the mediaeval *Bestiaries*, there is the tradition of stories in which animals are personified in order to teach a moral lesson" to humans.[39] Other favorable literary parallels between human nature and animal nature are found in Dante's *Divine Comedy*, where he uses various animals to symbolize assorted human passions, virtues, and vices,[40] and Machiavelli's *The Prince*, where he advises those humans seeking political power "knowingly to adopt the beast" and "to choose the fox and the lion."[41]

Yet, despite a rich tradition of egalitarian comparisons between human nature and non-human animal nature,[42] a parallel tradition of human prejudice—and even hostility—against animals also exists. The authors of the recent book *When Elephants Weep: The Emotional Lives of Animals*[43]

Hutchins ed., 1984) ("Upon the whole, the behaviour of these animals [mythical horse-like creatures called "Houyhnhnm"] was so orderly and rational, so acute and judicious, that I at last concluded, they must needs be magicians, who had thus metamporphosed themselves upon some design . . . or perhaps were really amazed at the sight of a man so very different in habit, feature and complexion . . . .").

As explained by environmental philosopher Christopher Manes, the 1960s TV character Mr. Ed is an example of the literary genre which has portrayed animals as *superior* to humans:

> Not only did Mr. Ed talk, he had better diction and seemingly a higher IQ than any of the humans around him. Even his name suggested a universal order turned on its head: he wasn't called Ed, but *Mr.* Ed; while his nominal master was just plain Wilbur.
>
> . . . .
>
> . . . He apparently wasn't supposed to be a freak of nature, like some equestrian Teenage Mutant Ninja Turtle. Often as not, Mr. Ed got Wilbur out of trouble through some piece of inside information wheedled from another horse . . . who was apparently just as clever as the star of the show, if less articulate. In Mr. Ed's world, all horses were intelligent, rational beings with more sense than the humans sitting in the saddles. That was the conceit played out in episode after episode, along with endless puns about horse sense.
>
> Like most good jokes, it was hardly original. To see society from an animal's point of view is an ancient literary device for gaining distance and apparent objectivity about ourselves. Chaucer used it in *The Parliament of Fowls*, as did George Orwell over half a millennium later in *Animal Farm*. It is the basis of the tenth-century Arabic text *The Island of the Animals* (which ends with the surprisingly egalitarian note that "Man is accountable to his Maker for the way in which he treats all animals, just as he is accountable for his behaviour towards his fellow human beings").

CHRISTOPHER MANES, OTHER CREATIONS: REDISCOVERING THE SPIRITUALITY OF ANIMALS 19-20 (1997).

39. 1 SYNTOPICON, *supra* note 8, at 20.

40. *See, e.g.*, DANTE ALIGHIERI, THE DIVINE COMEDY, *in* 21 THE GREAT BOOKS OF THE WESTERN WORLD 8 (Robert Maynard Hutchins ed., 1984) (a "raging" bull, or minotaur).

41. NICOLÒ MACHIAVELLI, THE PRINCE, *in* 23 THE GREAT BOOKS OF THE WESTERN WORLD 25 (Robert Maynard Hutchins ed., 1984).

42. *See supra* notes 36-41 and accompanying text.

43. JEFFREY M. MASSON & SUSAN MCCARTHY, WHEN ELEPHANTS WEEP: THE EMOTIONAL LIVES OF ANIMALS (1995).

summarize the interesting story of human smugness and hubris toward animals.[44] This arrogant philosophical perspective of "man-beast contrasts cites human advantages: our intelligence, our culture, our sense of humor, our knowledge of death." Human uniqueness is also claimed for "the ability to understand virtue [and] the ability to make and use tools."[45] Moreover, "[o]nly humans, it is said, feel noble emotions such as compassion, true love, altruism, pity, mercy, honor, and modesty" while low-level, inferior emotions like "cruelty, pride, greed, rage, vanity, and hatred" have been attributed to animals. "Thus not only whether animals can feel, but what they feel, is used to strengthen the species barrier" and to justify the practice of some humans to subordinate other animal species and seek a dominant status for *Homo sapiens*.[46]

To the extent, therefore, that human beings view *Homo sapiens* as superior and more worthy than other animals, the whole-organism cloning of a menagerie of animals will tend to be ethically justified (whether farm animals to provide us with more palatable food and drink, experimental animals to provide us with new and improved medicines, or wild animals to enhance our aesthetic sensibilities). To the extent that humans come widely to view other animals as morally equal to themselves, however, whole-organism cloning of both animals and humans will tend to be less robust and more restrained because of the ethical revaluation implicit in a belief of equal moral status.

2. Classification, Gradation, and Comparison of Animals

Closely related to the first philosophical issue of human versus non-human animal nature is the issue of continuities and discontinuities—differences in degree versus differences in kind—among various animal species. Indeed, for over two thousand years, thinkers have developed and elaborated upon classification schemes that grade life forms from lower to higher categories.

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44. *Id.* at 24-28.

45. *Id.* at 25.

46. *Id.* at 26-27. Masson and McCarthy noted:

> Thus the distinction between man and beast has served to keep man on top. People define themselves as distinct from animals, or similar when convenient or entertaining, in order to keep themselves dominant over them. Human beings presumably benefit from treating animals the way they do—hurting them, jailing them, exploiting their labor, eating their bodies, gaping at them, and even owning them as signs of social status. Any human being who has a choice does not want to be treated like this.

Id. at 27.

Closely related to emotional capacity, for purposes of differentiating human and non-human animal nature, is "*consciousness*." *See generally* DONALD R. GRIFFIN, ANIMAL MINDS (1992) (arguing, among other things, that ethologists have had a curious taboo to ignore the possibility that animals have conscious experience). *See also* GARY KOWALSKI, THE SOULS OF ANIMALS (1991) (arguing that animals are spiritual beings and the moral equivalent of humans).

Aristotle was the first Western intellectual to affirm a fundamental difference in kind and, consequently, a hierarchy between plants and animals. "In his biological writings, as well as in his treatise *On the Soul*, he draws a sharp line between plant and animal life by reference to faculties or functions absent in the one and found in the other."[47] Aristotle did not find any evidence that plants performed key functions performed by animals, like locomotion, sensation, and appetite. Rather, Aristotle saw these functions as "characteristic powers of the animal soul, called by him the 'sensitive soul' because sensation is the source both of animal desire and animal movement."[48]

Aristotle, Hippocrates, and Galen focused their comparative biological efforts on the anatomy and physiology of animal organisms, which were observed through dissection and gross observation. Later, during the Middle Ages, William Harvey did similar work regarding the circulation of blood and respiration of air and the mating habits (reproduction characteristics) of different classes of animals.[49] Harvey's comparative classification of animal reproduction characteristics was continued in the nineteenth and twentieth centuries by Charles Darwin and Sigmund Freud, respectively.[50]

Over the last two and a half millennia, the Western Intellectual Tradition has approached the taxonomy, classification, and gradation of animals by using two principal classification schemes: (1) the Aristotelian scheme, which focuses on similarities and differences between the "traits" or properties of different animals (a scheme adopted with some elaboration by Carl Linnaeus during the eighteenth century);[51] and (2) the Darwinian scheme, which "makes

47. 1 SYNTOPICON, *supra* note 8, at 20.

48. *Id.*

49. *Id.* at 21-22.

50. *Id.* at 22.

> Scientific learning has, of course, advanced in recent times with regard to the nature and behavior of animals. On such topics as heredity, the work of Mendel, Bateson, and Morgan is crucial; or, to take another example, our knowledge of the functioning of the respiratory and the nervous system [of various animals] has been greatly enlarged by the researches of Haldane, Sherrington, and Pavlov. Yet even in these areas, the background of recent scientific contributions is to be found in the great books—in the writings, for example, of Harvey, Darwin, and William James.

Id.

51. *Id.*

> The Aristotelian classification is most fully set forth in the *History of Animals*. There one kind of animal is distinguished from another by many "properties": by locale or habitat; by shape and color and size; by manner of locomotion, nutrition, association, sensation; by organic parts and members; by temperament, instinct, or characteristic habits of action. With respect to some of these properties, Aristotle treats one kind of animal as differing from another by a degree—by more or less—of the same trait. With respect to other properties, he finds the difference to consist in the possession by one species of a trait totally lacking in another. He speaks of the lion as being more

inferred genealogy or descent the primary criterion in terms of which [Darwin] group[ed] animals into varieties, species, genera, and larger phyla."[52]

Present-day animal classification schemes are a mix between the Aristotelian discrete "traits" approach and the Darwinian "genealogical" approach.[53] The functional essence of these schemes, however, is similar: at their heart, they seek to answer two anthropocentric questions. First, where do humans fit into evolution? Second, how similar or related are humans and other animals?[54] This way of classifying animal life, from the standpoint of whole-organism cloning, implies by analogy what we might label "A-view-of-the-

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> "ferocious" than the wolf, the crow as more "cunning" than the raven; but he also observes that the cow has an "organ of digestion" which the spider lacks, the lizard an "organ of locomotion" which the oyster lacks.

Id. at 22-23.

52. *Id.* at 23.

> Whereas the Aristotelian classification is static in principle, having no reference to temporal connections or the succession of generations, the Darwinian is dynamic—almost a moving picture of the ever-shifting arrangement of animals according to their affinities through common ancestry or their diversities through genetic variation.

Id.

53. *See* ERNST MAYR, TOWARD A NEW PHILOSOPHY OF BIOLOGY: OBSERVATIONS OF AN EVOLUTIONIST 283 (1988). Mayr discusses three "major schools of taxonomy"—an elaboration on the Aristotelian and Darwinian approaches. These categories are as follows: (a) *numerical phenetics* (grouping of animals by "inspection" or "outward appearance"—similar to the Aristotelian approach); (b) *cladistics* (or *cladism*) (classification based "exclusively on genealogy"); and (c) *evolutionary classification* (classification based on "observed similarities and differences among groups of organisms, evaluated in the light of their inferred evolutionary history"—similar to the Darwinian approach). *Id.* at 268-70.

54. *See generally* ERNST MAYR, THIS IS BIOLOGY: THE SCIENCE OF THE LIVING WORLD 227-47 (1997).

> [I]t was Darwin's [19th century] theory of common descent which left no escape from the conclusion that humans indeed had descended from apelike ancestors; the comparative morphological evidence had become overwhelming. A few years later Huxley, Haeckel, and others firmly established the principle that there was nothing supernatural about the origin of human beings. No longer isolated from the rest of the living world, *Homo sapiens* and its evolutionary history had become secularized into a branch of science.
>
> Slowly but inevitably a new biological discipline began to develop, human biology. It had multiple roots: physical anthropology, comparative anatomy, physiology, genetics, demography, cultural anthropology, psychology, and others. Its task was twofold: to show how humans are unique with respect to all other organisms, and yet to show how human characteristics evolved from those of our ancestors.
>
> How could one resolve the seeming contradiction between the fact that humans were animals and yet so fundamentally different from any other animals, even their closest relatives among the apes? The more carefully one studied humankind as well as the vast diversity of the world of life, the more one was impressed by the utter improbability of human beings. How could such an extraordinary creature have emerged from the animal kingdom?

Id. at 227-28.

world-from-the-perspective-of-a-Manhattanite." Pursuant to such a perspective, chimpanzees, bonobo monkeys, and African apes are the "Queens," "Brooklyn," and "Bronx" of our Manhattanite's map, with mammals being the "Chicago." The remainder of animal species (e.g., fishes, birds, lizards, amphibians, and etc.) are mere undifferentiated points in a vast, unimportant wasteland. Such a map assumes that humans will take very seriously (and perhaps erect a proof beyond a reasonable doubt standard) the ramifications of the whole-organism cloning of other human beings; that humans will seriously consider (with perhaps a preponderance of the evidence standard) the ramifications of whole-organism cloning of closely related apes; and that humans will not take seriously whole-organism cloning of other "lower" forms of animal species like birds, lizards, and fishes.

3. The Use and Abuse of Animals

Human interaction with animals has been characterized historically by what may be termed a two-track sensibility. On the one hand, legend and history are replete with accounts of mutual loyalty, devotion, and care between men and women and animals.[55] On the other hand, humans have often violently and wantonly mistreated animals in the name of economic utility, military necessity, or mere amusement.[56] While ancient religious and spiritual traditions have generally extolled the mystery and importance of animals co-existing in a

55. 1 SYNTOPICON, *supra* note 8, at 26. Moral justification for kind treatment of animals by humans is longstanding.

> Nor is such contrary teaching confined to Christianity, or to the maxims of St. Francis, who would persuade men to love not only their neighbors as themselves, but all of God's creatures. Plutarch, for instance, argues that through "law and justice we cannot, in the nature of things, employ on others than men," nevertheless, "we may extend our goodness and charity even to irrational creatures." In kindness to dumb animals he finds the mark of the "gentle nature"—the sign of man's humaneness. "Towards human beings as they have reason, behave in a social spirit," says [second century A.D. Roman Emperor-stoic philosopher] Marcus Aurelius; but he also writes: "As to animals which have no reason, and generally all things and objects, do thou, since thou hast reason and they have none, make use of them with a generous and liberal spirit."

Id.

Since the 1970s, a number of books and articles have been published on "animal rights" due in large part to "the attention paid in the 1960s to the rights of blacks, women, Vietnamese, and to a lesser extent, Native Americans, homosexuals, fetuses, the elderly, and students . . . ." RODERICK F. NASH, THE RIGHTS OF NATURE: A HISTORY OF ENVIRONMENTAL ETHICS 137 (1989). *See id.* at 129-44 (discussing and collecting intellectual history of animal rights movement).

56. 1 SYNTOPICON, *supra* note 8, at 26. *Cf. Animals: Teeth and Claws of the Gods*, *in* 1 MAN, MYTH AND MAGIC 89-93 (1970) (discussing cultural anthropology of primitive humans which "used" animal powers, without mistreating animals, through magical rituals and elevating some animals to the realm of gods).

"peaceable kingdom" with human beings,[57] modern secular culture has frequently marginalized animals and elevated human beings to a demi-godlike status.[58]

This ambiguous tradition of human-animal interaction (linked as it is with the two previously discussed equivocal issues involving the distinction between animal and human nature[59] and the continuity and discontinuity in assessing the scale of animal life)[60] is unlikely definitively to resolve humanity's view of the logic and limits of the whole-organism cloning of animal species. To the extent that animal cloning can be portrayed by its supporters as a "humane" and "non-painful" way to use animals for human purposes, little meaningful social opposition is likely to materialize to the whole-organism cloning of selected "domesticated" animals (like sheep, goats, cattle, and other animals with an agricultural genealogy). To the extent, however, that whole-body animal cloning is perceived by the public as interference with the life and dignity of "wild" animal species (like bears, wolves, and salmon), social opposition is likely to be more problematic. It appears just as likely, however, that public opinion could be attracted to the antipodes whereby adding additional numbers of wild animal species (especially if endangered but even if merely being unendangered, charismatic megafauna like seals and dolphins) through whole-organism cloning could be viewed as an overall environmental good.

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57. *See, e.g.*, MANES, *supra* note 38, at 10-11.

> The ancient Egyptians not only deemed many animals divine but organized their rituals in almost an obsessive manner to care for the remains of dead beasts. Various ancient Egyptian burial sites have yielded over a million mummified carcasses of cats, ibises, and other creatures, after thousands of years still waiting for the resurrection anticipated by their devout embalmers.

Manes also quoted scriptural verses from *Isaiah* 10:6-9 to demonstrate our culture's longing for a harmonious co-existence with animals:

> The wolf also shall dwell with the lamb, and the leopard shall lie down with the kid; and the calf and the young lion and the fatling together; and a little child shall lead them.
>
> And the cow and the bear shall feed; their young ones shall lie down together; and the lion shall eat straw like the ox.
>
> And the sucking child shall play on the hole of the asp, and the weaned child shall put his hand on the cockatrice' den.
>
> They shall not hurt nor destroy in all my holy mountain: for the earth shall be full of the knowledge of the Lord, as the waters cover the sea.

Id. at 213.

58. *Id.* at 215. "Everywhere 'Man' has replaced creation with his own artifacts, both physically and intellectually. We wonder why the sacred appears absent from our lives, yet everything that saints, seers, and prophets once invoked to express humanity's relationship with the divine seems to be receding in the face of Man's talkative centrality." *Id.*

59. *See supra* notes 36-46 and accompanying text.

60. *See supra* notes 47-54 and accompanying text.

4. Sexual Being and Nothingness

In the tradition of ontology—the philosophy of being[61]—a few important abstract questions could impact one's view of human whole-organism cloning in relation to non-human animal whole-organism cloning. An initial cross-cutting question is: what does "to be" and "to exist" mean? Given our experience in the world, it really does not matter whether a human animal is comprised of artificial components (like clothing, eyewear, dentures, artificial heart, transplanted heart, prosthetics, and etc.) or was derived from non-sexual reproduction techniques (like a surrogate mother, *in vitro* fertilization, and etc.). The key would seem to be assuring ourselves that the human being was "real" as opposed to "illusory." Thus, a corporeal, material mind and body with human characteristics who "came from" a sexual or non-sexual process of reproduction involving male and female reproductive elements (sperm and egg) would likely be viewed as a "real" human being. Expressed in a slightly different fashion, it would not matter to us whether a non-human whole-organism cloned animal is comprised of artificial components (like a dog or cat collar, or a horse prosthesis) or was reproduced through non-sexual reproductive technology as long as we culturally accepted the artificial and non-sexual component in the animal. For example, we might, or might not, have a problem in accepting the reality of a raccoon with an artificial heart or a dog born of a surrogate mother.

A deeper cross-cutting question hones in on the sexual presuppositions we might harbor about a real, as opposed to an illusory, human or non-human. Do we culturally demand that human beings be the product of male sperm input and female egg input, regardless of our apparent cultural acceptance of children who are not born of a sexual union of male and female? Given our cultural antecedents (religion, legal tradition, human institutional expectancy interests, and the like) I think, for example, that most of us would have great difficulty

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61. Ontology has been defined as follows:

> 1. the study of the essential characteristics of being in itself, apart from the study of particular existing things. In studying being in its most abstract form, ontology asks questions such as "What is being-in-itself?" "What is the nature of being-as-being?"
> 2. the branch of philosophy that deals with the order and structure of reality in the broadest sense possible, using categories such as being/becoming, actuality/potentiality, real/apparent, change, time, existence/nonexistence, essence, necessity, being-as-being, self-dependency, self-sufficiency, ultimate. . . .
>
> Ontology has been used as a synonym or has been regarded as a branch of metaphysics. But it can be seen to be close to other branches of philosophy, as well, such as epistemology, philosophical analysis, and semantics. Its similarities to theology are also obvious. What Aristotle refers to as first philosophy is ontology.

PETER A. ANGELES, THE HARPER COLLINS DICTIONARY OF PHILOSOPHY 213-14 (1992) (selective format changes).

in philosophically accepting a whole-organism cloned human being with the same functional pedigree as Dolly the sheep—three mothers and no father. We have certainly come to expect that after conception a human father may voluntarily or involuntarily leave the upbringing of his offspring entirely to a mother, but we have not had sufficient time to ponder the implications of allowing humans to be born with no proximate male biological input. A possible response to this concern might be that the human clone parent would likely have a male and female sexual pedigree (e.g., "Grandpa came from good stock, by golly. He was born as a product of both a sperm and an egg!").

For the cultural reasons discussed in addressing the related issues of the distinction between animal and human nature,[62] continuity and discontinuity in assessing the scale of animal life,[63] and human use and abuse of animals,[64] I suspect that, for the most part, we would not have a serious ontological hangup about whole-organism cloned animals. What does it matter, for instance, if a chicken came from merely a cloned mother or from both male and female biological inputs (sexual or not)? Does it taste as good as the Colonel's Original Recipe? Then who cares? This same analysis would apply to any animal that humans consumed for food or directly used for non-food purposes (e.g., cattle for leather, sheep for wool). Sentimentality, a cultural wild card of sorts, might alter this human attitude in the case of domestic pets or wild animals where we might come to value the aesthetic quality of animals made "the good old fashioned way" (e.g., championship show horses or championship show dogs). Indeed—from the perspective of Deep Ecology, which accords wild things a right to be for their own vital reasons as opposed to merely human reasons[65]—we might object to cloned wild creatures. But, as discussed in the next Part, what if a species of wild creature was on the verge of extinction? Would it be in *its own* interests to live on, even as clones? Would it be in the interests of other wild animals? Of human beings?[66]

5. Cloning and the Revenge of Unintended Consequences

Technology has a dark side as well as a bright side. The former is colorfully described as "revenge effects" in the words of Edward Tenner's book *Why Things Bite Back: Technology and the Revenge of Unintended Consequences*:[67]

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62. *See supra* notes 36-46 and accompanying text.
63. *See supra* notes 47-54 and accompanying text.
64. *See supra* notes 55-60 and accompanying text.
65. NASH, *supra* note 55, at 146-52.
66. *See infra* notes 103-38 and accompanying text.
67. EDWARD TENNER, WHY THINGS BITE BACK: TECHNOLOGY AND THE REVENGE OF UNINTENDED CONSEQUENCES (1996).

> Why are the lines at automatic cash dispensers . . . longer in the evening than those at tellers' windows used to be during banking hours? Why do helmets and other protective gear help make football more dangerous than rugby? Why do filter-tip cigarettes usually fail to reduce nicotine intake? Why has yesterday's miracle vine become today's weed from hell? And why have today's paperback prices overtaken yesterday's clothbound prices? Why has the leisure society gone the way of the leisure suit?
>
> *The real revenge is not what we do intentionally against one another. It is the tendency of the world around us to get even, to twist our cleverness against us. Or it is our own unconscious twisting against ourselves. Either way, wherever we turn we face the ironic unintended consequences of mechanical, chemical, biological, and medical ingenuity—revenge effects, they might be called.*[68]

Despite the cacophony of upbeat assessments of future biomolecular technological advances,[69] what are the potential revenge effects of whole-organism cloning of human and non-human animals? With regard to human whole-organism cloning, there is, first, the potential moral/social danger that parents—when offered the enhanced technological prospect of cloning cells from ideal third-party types (e.g., Elizabeth Taylor, Michael Jordan, or Mother Teresa)—might come to view their cloned child (with the transferred genetic material carried in the womb of the mother-to-be or in another human womb-mother, to take two possible examples) as a commodity whereby the parents' hope of generating a particular person (i.e., a movie star, basketball superstar, or global saint) are paramount. In such a circumstance, where "cloning human beings is undertaken in the hope of generating a particular kind of person, a person whose standards of what matters in life are imposed from without,"[70] current American moral sensibilities would likely view this type of cloning transaction as "morally repugnant."[71] This would probably be the case "not because it involves biological tinkering but because it is continuous with other ways of interfering with human autonomy that we ought to resist."[72] In effect, "[h]uman cloning [under such circumstances] would provide new ways of

68. *Id.* at 6 (emphasis added). Tenner's book cites and relies upon an impressive body of literature regarding the unintended consequences of various types of technology. *See id.* 355-59. For a classic book within this body of literature, see JOHN MCPHEE, THE CONTROL OF NATURE (1989) (discussing the paradoxes and unanticipated impacts of human attempts to control the environment).

69. *See supra* notes 7-29 and accompanying text.

70. KITCHER, *supra* note 5, at 335.

71. *Id.*

72. *Id.*

committing old moral errors."[73] Indeed, "[t]o discover whether or not there are morally permissible cases of [whole-organism] cloning [of human beings], we need to see if this objectionable feature can be removed" and if it is feasible to identify "situations in which the intention of the prospective parents is properly focused on the quality of human lives *but in which cloning represents the only option for them.*"[74]

According to Professor Philip Kitcher's analysis, "[t]hree scenarios come immediately to mind": the dying child, the grieving widow, and the loving lesbians. As explained by Kitcher:

> *The case of the dying child.* Imagine a couple whose only son is slowly dying. If the child were provided with a kidney transplant within the next ten years, he would recover and be able to lead a normal life. Unfortunately, neither parent is able to supply a compatible organ, and it is known that individuals with kidneys that could be successfully transplanted are extremely rare. However, *if a brother was produced by cloning, then it would be possible to use one of his kidneys to save the life of the elder son.* Supposing that the technology of cloning human beings has become sufficiently reliable to give the couple a very high probability of successfully producing a son with the same complement of nuclear genes, is it permissible for them to do so?
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> *The case of the grieving widow.* A woman's much-loved husband has been killed in a car crash. As the result of the same crash, the couple's only daughter lies in a coma, with irreversible brain damage, and she will surely die in a matter of months. The widow is no longer able to bear children. Should she be allowed to have the nuclear DNA from one of her daughter's cells inserted in an egg supplied by another woman, and to have a clone of her child produced through surrogate motherhood?
>
> *The case of the loving lesbians.* A lesbian couple, devoted to one another for many years, wishes to produce a child. Because they would like the child to be biologically connected to each of them, they request that a cell nucleus from one of them be inserted in an egg from the other, and that the embryo be implanted in the woman who

73. *Id.* at 335-36.
74. *Id.* at 336 (emphasis added).

donated the egg. (Here, one of the women would be nuclear mother and other would be both egg mother and womb mother.) Should their request be accepted?[75]

A second category of potential "revenge effects" of human whole-body cloning, at least in the early developmental phase of the technology, is the risk that a cloned pregnancy "will go awry, producing a child whose development is seriously disrupted."[76] Future development of technology for cloning human beings might present unsavory problems of "researchers [who] would generate malformed fetuses and, from time to time, children with problems undetectable before birth."[77] A strong argument can be made that human whole-organism cloning should be banned until such time, if ever, when these technical problems are resolved (by computer simulation and mammalian laboratory experimentation).[78]

Under a Deep Ecology perspective,[79] the two aforementioned categories of potential "revenge effects"[80] could be applicable to the case of whole-organism cloning of non-human animal organisms. However, prevailing cultural norms, which differentiate human from non-human life, devalue non-human

75. *Id.* (emphasis added). Exhaustive moral analysis of the implications of human whole-organism cloning is beyond the scope of this article. Suffice it to say that, according to Professor Kitcher, while all three of the textual scenarios involve "no blatant attempt to impose the plan of a new life, to interfere with a child's own conception of what is valuable," the first two scenarios ("the case of the dying child" and "the case of the grieving widow") trigger "suspicion that [human] children are being subordinated to special adult purposes and projects." *Id.* at 337.

By way of contrast, according to Kitcher, the third scenario involving "[t]he case of the loving lesbians is the purest of the three, for here we seem to have a precise analogue of the situation in which heterosexual couples find themselves." *Id.* at 338.

> Cloning would enable the devoted pair to have a child biologically related to both of them. There is no question of imposing some particular plan on the nascent life, even the minimal one of hoping to save another child or to serve as a reminder of the dead, but simply the wish to have a child who is their own, the expression of their mutual love. If human cloning is ever defensible, it will be in contexts like this.

Id.

But query: would it be justified for society to decline to allow same-sex initiated human whole-body cloning on the social theory that a child should have the opportunity for both a mother and a father parental role model for proper human development?

76. *Id.* at 339.

77. *Id.*

78. A related prudential bioethical principle, applicable to transgenetic cloning experiments involving human and nonhuman animals, can be stated as follows: "Until we have a better understanding of the extent of genetic exchange between distantly related species in nature, we ought to consider evolutionary 'boundaries'—areas of relatively limited genetic exchange—as at least provisional warning signs of potential danger zones for the casual transfer of recombinant genes between species." SUZUKI & KNUDTSON, *supra* note 11, at 250.

79. *See supra* note 65 and accompanying text.

80. *See supra* notes 67-78 and accompanying text.

existence, and justify human manipulation of the natural world,[81] would not be troubled by moral motivation or deformities of animal embryos done in the name of cloning. However, an assortment of ecological concerns might give pause to a thoughtful and knowledgeable observer regarding the potential impacts of cloning whole-organism offspring of both human and animal species. These ecological considerations, addressed in Eugene P. Odum's book,[82] include the following: species composition, size of individuals, species diversity, total biomass, non-living organic matter, energy flow (community metabolism), biogeochemical cycles, and natural selection dynamics.[83]

IV. WHOLE-ORGANISM CLONING OF ENDANGERED ANIMAL SPECIES

A. *"The Company We Keep": The Endangered Special Act Paradigm*

As Douglas Chadwick and Joel Sartore note,

> Humans are one of about 1.75 million species that have been identified by science, and many believe that 30 million species or more inhabit this world we call ours. Experts predict that at least one of every four of these life-forms may become extinct by the year 2050, less than a single human lifetime away.[84]

Since the 1500s, roughly 500 known species and subspecies of animals and plants have gone extinct in North America; among these dead species are the emerald trout, the great auk, the West Indian monk seal, the Labrador duck, the

81. *See supra* notes 36-60 and accompanying text.

82. EUGENE P. ODUM, ECOLOGY AND OUR ENDANGERED LIFE-SUPPORT SYSTEMS (1989).

83. *Id.* at 195 (Table 1). One scientist has pointed out that cloning would stop natural selection and evolution:

> In sexual reproduction, some of the genetic material from each parent undergoes mutations that can lead to entirely new biological properties. Vast numbers of individual combinations become possible, and the requirements of survival—and choices of partners by the opposite sex—then gradually select which features will be passed on to the following generations.
>
> Cloning will, in contrast, reproduce the same genetic makeup of an existing individual. There is no room for new traits to arise by mutation and no room for desirable features to compete and win by an appeal to the judgment of the opposite sex. The result: . . . evolution is halted.

Michael Mautner, *Will Cloning End Human Evolution?*, FUTURIST, Nov. 21, 1997, at 68.

84. CHADWICK & SARTORE, *supra* note 2, at 17.

> It is natural for species to go extinct—but at an average rate of *one out of every million per century*, based upon the fossil record. *The current rate may already be as high as several per day*. A biological cataclysm of this magnitude hasn't occurred since the end of the Cretaceous period, when the dinosaurs went under along with many other major groups.

Id. (emphasis added).

Audubon's bighorn sheep, the heath hen, the sea mink, and the Eskimo curlew.[85] In a recent edition of the prestigious journal *Science*, the current rate of worldwide animal and plant species extermination has been estimated to be *one species lost every fifteen minutes*. This translates into 96 dying species per day, or 672 per week, or approximately 35,000 extinct species per year.[86]

Substantial animal conservation efforts in the United States did not begin until the turn of the twentieth century when faced with "the end of the frontier" "Americans finally paused to take stock."[87] In a series of ad hoc federal laws and administrative actions implemented over the next seven decades, Congress and the Executive attempted to respond to various wildlife crises on a case-by-case basis.[88] It was not until the Endangered Species Act of 1973 that the

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85. *Id.*

86. WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW 995 n.173 (2d ed. 1994) (citing C.C. Mann, *Extinction: Are Ecologists Crying Wolf?*, 253 SCI. 736 (1991) (citing the estimate of biologist E.O. Wilson that present extinction rate is 100,000 species per year)).

87. CHADWICK & SARTORE, *supra* note 2, at 18.

88. *Id.* at 18-24. A panoramic description of these federal species protection measures is as follows:

> In 1907, when 15 surviving bison [in the United States out of 60 to 70 million bison in the early 1600s] were shipped by train from the Bronx Zoo to reseed a newly established sanctuary in Oklahoma's Wichita Mountains, crowds gathered at each whistlestop, curious, and perhaps a little ashamed, cheering the shaggy beasts onward. More cheering was heard in 1935, when Congress set aside Red Rock Lakes National Wildlife Refuge in Montana's upper Centennial Valley for the sake of the last known trumpeter swans in America.
>
> [O]nly 73 . . . Southern trumpeters had been found from coast to coast, but they migrated, flying a continental gauntlet of shotgun fire twice every year. The largest of the world's waterfowl, borne on wings ten feet across, trumpeter swans were hard to miss, and they were rendered into roasts, pillow stuffing, powder puffs, gloves, and writing quills by the hundreds of thousands.
>
> . . . .
>
> With swans having been transplanted from Red Rock Lakes to several other sites in the West, southern trumpeters number almost 3,000 today and appear to be holding their own. . . .
>
> . . . .
>
> Many other wildlife refuges and national parks were set aside as havens in the early part of the [20th] century as the federal government assumed a larger role in protecting natural resources. Conservation groups continued to gain members. Game laws and the emerging field of wildlife management encouraged the protection of hunted animals. Yet all kinds of species lumped together as "non-game" were falling through this loosely woven safety net, particularly big carnivores. . . .
>
> By the middle of the 20th century, it was getting harder to deny that something was seriously amiss in the wildlife kingdom. The grandest carnivore in the lower 48 states, the grizzly bear, was reduced to fewer than 1,000 as chain saws and bulldozers chewed away at the last backcountry strongholds in the Rockies. The biggest creatures that ever took breath, the great whales, looked to be headed the way of the dodo. Though they had all the world's seven seas to roam, there was not enough room to

federal government responded in a serious, comprehensive manner to the plight of endangered species.[89]

The Endangered Species Act of 1973, as amended,[90] contains four key provisions in sections 4,[91] 7,[92] 9,[93] and 10.[94] These core sections require

> that endangered species be identified, that their essential habitat be designated, that federal agencies not jeopardize these species, or adversely modify their habitat, that federal actions likely to jeopardize be exempted only in extraordinary circumstances, that plans be prepared and implemented for species recovery, and that private parties not harm these species without undertaking remedial planning.[95]

The 1978 opinion of the United States Supreme Court in *TVA v. Hill*[96] created a powerful and convincing rationale for an interpretation of section 7's no federal jeopardy provisions of the Endangered Species Act. This opinion interprets the provisions as an absolutist measure that "admits no exception" and the congressional evaluation of endangered species like the snail darter (a three-inch perch-like fish) as of "incalculable" value.[97] *TVA v. Hill*, along with the generally clear statutory language of the Endangered Species Act, has led to several cases in which the presence of endangered species has delayed, impeded, or blocked public and private economic interests. The influence of *TVA v. Hill* has not diminished, notwithstanding the Supreme Court's 1992 ruling in *Lujan v. Defenders of Wildlife*[98] that formulated and applied a restrictive version of the standing doctrine, a version that blocked an attack by wildlife conservation

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> escape modern whaling technology. The country's biggest reptiles, the American alligator and American crocodile, were being poached out of existence in what had long been portrayed as impenetrable swamps. The peregrine falcon, able to dive at speeds in excess of 150 miles per hour, was rarely seen in the U.S. anymore. Even America's national symbol, the bald eagle, was in a tailspin and in danger of disappearing from the lower 48 states, though it had been protected from shooting since 1940.

Id. at 18-19.

89. *See generally id.* at 20-22 (quoting portions of 16 U.S.C. and explaining evolution of federal endangered species protection policy leading up to the Endangered Species Act of 1973).

90. 16 U.S.C. § 1531 (1997).

91. 16 U.S.C. § 1533 (1997).

92. 16 U.S.C. § 1536 (1997).

93. 16 U.S.C. § 1538 (1997).

94. 16 U.S.C. § 1539 (1997).

95. Oliver A. Houck, *The Endangered Species Act and Its Implementation by the U.S. Department of Interior and Commerce*, 64 U. COLO. L. REV. 277, 278 (1993).

96. 437 U.S. 153 (1978).

97. *Id.* at 187.

98. 504 U.S. 555 (1992).

organizations on a Department of Interior rule that limited the requirement of agency consultation under subsection 7(a)(2) to actions taken in the United States or on the high seas and not to actions taken in foreign nations.

Lower court opinions generally reflect the great social and economic upheaval wrought by the Endangered Species Act and the judiciary's tendency to take the Act seriously.[99] However, in recent years, a "property rights" backlash has arisen against the Endangered Species Act because it restrains private property owners from certain uses of their land in order to secure the "public good" of species protection.[100]

What about cloning endangered species?[101] What is the case for an aggressive government whole-organism cloning policy to save endangered

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99. *See, e.g.*, Northern Spotted Owl v. Hodel, 716 F. Supp. 479, 483 (W.D. Wash. 1988) (holding that U.S. Fish & Wildlife Service's failure to list northern spotted owl as endangered or threatened under Endangered Species Act was arbitrary and capricious); Thomas v. Peterson, 753 F.2d 754, 765 (9th Cir. 1985) (holding that U.S. Forest Service failed to comply with the Act in considering effects of proposed road through national forest on endangered Rocky Mountain Gray Wolf).

100. *See generally* Jerry Taylor, *Environmental Protection*, *in* CATO'S HANDBOOK FOR CONGRESS 426-427 (1997).

101. For recent books on cloning law and policy, see PAUL BERG, DEALING WITH GENES: THE LANGUAGE OF HEREDITY (1992); KARL DRLICA, UNDERSTANDING DNA AND GENE CLONING: A GUIDE FOR THE CURIOUS (1992); STEPHEN S. HALL, INVISIBLE FRONTIERS (1988); TED HOWARD & JEREMY RIFKIN, WHO SHOULD PLAY GOD? THE ARTIFICIAL CREATORS OF LIFE AND WHAT IT MEANS FOR THE FUTURE OF THE HUMAN RACE (1977); PAUL HUGLI, CLONING, TEST-TUBE BABIES AND GENETIC ENGINEERING (1985); MARGARET O. HYDE, CLONING AND THE NEW GENETICS (1984); GINA B. KOLATA, THE ROAD TO DOLLY AND THE PATH AHEAD (1998); PETER SINGER, MAKING BABIES: THE NEW SCIENCE AND ETHICS OF CONCEPTION (1985); FAY WELDON, THE CLONING OF JOANNA MAY (1990).

For other recent, miscellaneous law review articles regarding cloning-related issues, see generally Rebecca Dresser, *Ethical and Legal Issues in Patenting New Animal Life*, 28 JURIMETRICS J. 399 (1988); Richard Gold, *Owning Our Own Bodies: An Examination of Property Law and Biotechnology*, 32 SAN DIEGO L. REV. 1167 (1995); Michael J. Malinowski & Maureen A. O'Rourke, *A False Start? The Impact of Federal Policy on the Genotechnology Industry*, 13 YALE J. ON REG. 163 (1996); Stephen A. Newman, *Human Cloning and the Family: Reflections on Cloning Existing Children*, 13 N.Y.L. SCH. J. HUM. RTS. 523 (1997); Diana Scheiness, *Patenting Gene Sequences*, 78 J. PAT. & TRADEMARK OFF. SOC'Y 121 (1996); Mona S. Amer, Comment, *Breaking the Mold: Human Embryo Cloning and Its Implications for a Right to Individuality*, 43 UCLA L. REV. 1659 (1996); Debra Feuerberg Duffy, Note, *To Be or not to Be: The Legal Ramifications of the Cloning of Human Embryos*, 21 RUTGERS COMPUTER & TECH. L.J. 189 (1995); Terri A. Jones, Note, *Patenting Transgenic Animals: When the Cat's Away, the Mice Will Play*, 17 VT. L. REV. 875 (1993); Elizabeth Ann Pitrolo, Comment, *The Birds, the Bees, and the Deep Freeze: Is There International Consensus in the Debate over Assisted Reproductive Technologies?*, 19 HOUS. J. INT'L L. 147 (1996); Ted M. Sichelman, *Improving Nature? The Science and Ethics of Genetic Engineering*, 10 HARV. J.L. & TECH. 707 (1997) (reviewing MICHAEL J. REISS & ROGER STRAUGHAN, IMPROVING NATURE? THE SCIENCE AND ETHICS OF GENETIC ENGINEERING (1996)).

species under American law? In contrast, what is the case against an aggressive government whole-organism cloning policy to save beleaguered species under American law?[102]

B. The Case for an Aggressive Government Cloning Policy

1. By boldly pursuing whole-organism cloning of endangered animal species throughout the world—wherever the jurisdiction of the United States arises—the federal government would help stop the extinction and threatened extinction of endangered animals and thereby ameliorate the "biodiversity crisis" plaguing the planet. "Biological resources now being rapidly lost" in "the greatest episode of extinction ever to occur" upon the earth have been described as "nonreplicable sources of information, of wealth, of political stability, of human comfort, happiness, and joy."[103] Indeed, Professor William H. Rodgers, Jr. of the University of Washington School of Law, in order to describe humanity's continued destruction of endangered species, has collected a number of quotations from other thoughtful observers which use the poignant metaphor of allowing library books to burn without ever having read the books.[104]

Cloning endangered animals would be an effective way to prevent species extinction, at least in the short run. It would be akin to a "Noah's Ark Strategy," to mix metaphors a bit, or to a library replication policy to conform with the aforementioned "genetic library" metaphor.

2. An aggressive federal governmental policy of cloning endangered animal species would be consistent with the language and spirit of the Endangered Species Act[105] as interpreted by the courts. In *TVA v. Hill*, in a landmark

102. *See generally* Jon Cohen, *Can Cloning Help Save Beleaguered Species?*, 276 SCI. 1329 (1997) (discussing the pros and cons of cloning animals).

103. RODGERS, *supra* note 86, at 995.

104. *Id.* at 995 n.174. Professor Rodgers' insightful footnote, quoted in its entirety, is as follows:

> *Compare* J.D. Dingell, *The Endangered Species Act: Legislative Perspectives on a Living Law*, *in* [BALANCING ON THE BRINK OF EXTINCTION: THE ENDANGERED SPECIES ACT AND LESSONS FOR THE FUTURE] 25, 26 [K.A. Kohm ed. 1991] ("Living wild species are like a library of books still unread. Our heedless destruction of them is akin to burning that library without ever having read its books") *and* N. MYERS, THE SINKING ARK: A NEW LOOK AT THE PROBLEM OF DISAPPEARING SPECIES (1979) *and* P. & A. ERLICH, EXTINCTION: THE CAUSES AND CONSEQUENCES OF THE DISAPPEARANCE OF SPECIES 95 (1981) (on the "genetics library") *with* W.H. Rodgers, Jr., *A Constitutional Law of the Environment*, *in* AMERICAN LAW INST./AMERICAN BAR ASS'N., BLESSING OF LIBERTY: THE CONSTITUTION AND THE PRACTICE OF LAW 63, 71-77 (1988) (using the "genetics library" arguments to develop a First Amendment theory of environmental protection).

105. 16 U.S.C. §§ 1531-44 (1997).

opinion by Chief Justice Burger, the Court discerned a principle of "institutionalized caution"[106] regarding the congressional judgment that the value of endangered species, or any endangered specie, for that matter, is "incalculable."[107]

3. A proactive federal governmental policy of whole-organism cloning of endangered animal species would also conform to the language and spirit of *Agenda 21*—the United Nations' Program of Sustainable Development which the international community agreed to at the 1992 Earth Summit in Rio de Janeiro.[108] Specifically, an aggressive United States government policy of cloning endangered animal species would dovetail with relevant language of *Agenda 21*'s "conservation of biological diversity" chapter which provides, in relevant part, that "[o]ur planet's essential goods and services depend on the variety and variability of genes, species, populations and ecosystems";[109] that "[u]rgent and decisive action is needed to conserve and maintain genes, species and ecosystems, with a view to the sustainable management and use of biological resources";[110] that "[c]apacities for the assessment, study and systematic observation and evaluation of biodiversity need to be reinforced at national and international levels";[111] that "[e]ffective national action and international cooperation is required for the *in situ* protection of ecosystems, for the *ex situ* conservation of biological and genetic resources and for the enhancement of ecosystem functions";[112] and that "[nation] [s]tates have the sovereign right to [use] their own biological resources pursuant to their environmental policies [dealing with biotechnology], as well as the responsibility to conserve their biodiversity and use their biological resources sustainably, and to ensure that activities within their jurisdiction or control do not cause damage to the biological diversity of other [nation] [s]tates or of areas beyond the limits of national jurisdiction."[113]

4. A dynamic and proactive governmental whole-organism cloning policy would facilitate the eventual use of frozen fibroblast cells of long-deceased individual members of endangered animal species, maintained at leading American zoos.

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106. 437 U.S. 153, 194 (1978).

107. *Id.* at 187.

108. *See generally* RICHARD N. GARDNER, NEGOTIATING SURVIVAL: FOUR PRIORITIES AFTER RIO 1 (1992); Robert F. Blomquist, *Virtual Borders? Some Legal-Geo-Philosophical Musings on Three Globally Significant Fragile Ecosystems Under United Nations' Agenda 21*, 45 CLEV. ST. L. REV. 23 (1997).

109. UNITED NATIONS, AGENDA 21: THE UNITED NATIONS PROGRAM OF ACTION FROM RIO, para. 15.2, at 131 (1993) [hereinafter AGENDA 21).

110. *Id.*

111. *Id.*

112. *Id.*

113. *Id.*

Cloned animals from frozen fibroblast cells "would then be able to breed" with remaining individuals of an endangered animal specie, thus "reintroducing the lost genes back into the [specie's] population, . . . and recover[ing] the genetic diversity."[114]

5. A vigilant federal governmental policy of encouraging cloning of endangered animal species would benefit "biologists trying to save species that don't breed well in captivity, such as giant pandas."[115] This is because "[t]he more offspring an animal has . . . the more of its genome it will pass on [under a formula where the amount of an organism's genetic material transmitted is equal to 1-1/2 n, where n equals the number of offspring]."[116] For example, "[i]f a giant panda in a zoo has only one offspring, one-half of the panda's genes are lost. But if biologists could clone the panda 10 times and each one produced an offspring, in effect, the original panda would have produced 10 offspring, and fully 95% of its genetic information would have been 'captured'."[117]

6. A bold federal approach to cloning endangered animal species would include modest federal funding for non-human whole-body cloning of animals (endangered as well as non-endangered domestic animals). This would provide a variety of advantages to the American scientific community: to overcome the daunting technical hurdles that still exist for would-be cloners of various types of animals; to foster open and rational discourse among scientists and the public about potentially vexing issues of ethics (the most serious future issue in this field being whether, or when, or how human cloning should take place); to give solid basis for formal federal oversight of cloning research, if that became socially desirable; to provide cost-effective biological research in an area of potential national strategic interest; and to explore potential benefits of cloning in feeding people and curing their ills while probing other useful applications that the scientists do not yet foresee.[118]

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114. Cohen, *supra* note 102, at 1329.

115. *Id.*

116. *Id.* at 1329-30.

117. *Id.* Moreover,

> Cloning might even serve a useful purpose with species that have never bred in captivity, such as the giant armadillo, by allowing biologists to asexually reproduce the creatures. This scenario, which would require implanting a cloned embryo of a giant armadillo in a more common relative, adds to the [still-too-be-overcome] already formidable list of scientific obstacles[, but, according to Oliver Ryder of the San Diego Zoo's Center for Reproduction of Endangered Species,] . . . "[such a strategy] could possibly guarantee genetic immortality."

Id. at 1330.

118. Tabitha M. Powledge, *Good-Bye, Dolly*, 100 TECH. REV. 5 (1997). An assortment of technical hurdles are facing would-be-cloners of animals, in general, including the following: the very low success rate of animal cloning (Dolly involved 277 attempts to clone one lamb); whether zoologists could use fibroblasts of former zoo animals instead of mammary cells (used in Dolly's

7. An aggressive federal endangered species whole-organism animal cloning program would substantially mitigate the sometimes harsh effects of wildlife preservation laws, including the often severe economic dislocations imposed on various communities and various productive economic activities,[119] while saving endangered animal species from extinction. This is a reasonable accommodation of interests, consistent with the principles of the Endangered Species Act and the international biodiversity obligations of the United States.

C. The Case Against an Aggressive Government Cloning Policy

1. An aggressive governmental cloning policy for endangered animals constitutes a "smoke and mirrors" deception. As Michael Soule, an emeritus population geneticist at the University of California, Santa Cruz, opines, "I don't want people to think that [cloning is] a solution to a major problem."[120] Even assuming that the formidable technical hurdles to widespread whole-organism cloning of a variety of endangered animal species could be overcome,[121] "cloning endangered species could distract people from saving habitats,"[122] which are widely recognized as the *summum bonum* of biodiversity preservation.[123]

2. A dramatic, comprehensive federal policy to clone endangered animal species would be extremely costly and tend to displace other more cost-effective

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case); the feasibility of harvesting eggs in a "ripened" state in situations (unlike Dolly's) where the animal reproductive system is not well understood (for example, a Sumatran white rhinoceros); the lack of present scientific knowledge of the proper nutritive media in laboratory cultures of harvested animal eggs; the challenge of finding an appropriate womb mother for an animal embryo in the case of cloning endangered animal species. Cohen, *supra* note 102, at 1330.

119. *See* DANIEL STARER, HOT TOPICS 221 (1995):

> According to the Interior Department, 31,000 jobs in the Pacific Northwest will disappear over the next twenty-five years directly due to plans to protect the spotted owl. Overzealous environmental regulations harm other industries even more. According to the American Petroleum Industry, more than 400,000 American oil-industry jobs have already been lost in part because of environmental regulations. The loss of related jobs is even higher. For each offshore oil-drilling job lost, local economies lose an additional four onshore jobs. An estimated 700,000 new jobs will never be created because Congress rejected a proposal to permit oil drilling in Alaska's Arctic National Wildlife Refuge.

Id. Moreover, the aforementioned adverse economic impacts have second-order consequences: to wit, lost jobs to foreign competitors happy to employ their own workers while Americans suffer unemployment. *Id.*

120. Cohen, *supra* note 102, at 1330.

121. *See supra* note 118.

122. Cohen, *supra* note 102, at 1330.

123. RODGERS, *supra* note 86, at 1007 ("habitat is *the* crucial parameter for species survival" from a biological perspective and the legal reason that "critical habitat is protected from impairment or modification under Section 7 [of the Endangered Species Act]").

conservation efforts. "[M]any conservation biologists argue that efforts to clone endangered species would be so expensive that they could derail other conservation efforts."[124] David Wildt, head of reproductive physiology at the U.S. National Zoo's Conservation and Research Center in Front Royal, Virginia, expressed that policymakers should only view whole-organism cloning of endangered animals as a "last, desperate attempt to try to preserve a given species."[125] According to this perspective, "cloning" is so expensive and technically challenging that it should be used only "with 'a fairly narrow window' of species"[126] that have less than 100 known animals of the specie in existence. In most cases, a breeding program is far more cost-effective than cloning.[127]

3. Cloning, an asexual form of reproduction, will tend to "reproduce the same genetic makeup of an existing individual" and impede the dynamic process of evolutionary change and recombination of genotypes,[128] with the possible narrow exception of zoo cloning of frozen fibroblast cells of long-deceased individual members of endangered animal species.[129] In the long run, this undermines the larger concept of biodiversity enunciated in *Agenda 21*.[130] This negative policy outcome, more homogenous and less diverse genes, is related to the negative policy outcome discussed above involving emphasis on species preservation at the expense of habitat preservation.[131]

4. Because human beings owe animals a substantial moral respect, if not moral equality,[132] it would be unethical for the federal government to pursue a bold new policy of cloning endangered animal species—except in extreme emergencies where an animal specie is at risk of immediate extinction because the known individual survivors of the specie are scarce.[133]

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124. Cohen, *supra* note 102, at 1329 (stating that "'In the end, the very finite resources that conservation has are better directed elsewhere,' contends Michael Bruford, a molecular geneticist at the Zoological Society of London's Institute of Zoology.")

125. *Id.*

126. *Id.* at 1330.

127. *Id.*

128. *See supra* note 83 and accompanying text.

129. *See supra* note 114 and accompanying text.

130. *See supra* note 109 and accompanying text.

131. *See supra* notes 120-23 and accompanying text.

132. *See supra* notes 36-46 and 55-66 and accompanying text. *See also* ENVIRONMENTAL ETHICS: READINGS IN THEORY AND APPLICATION 155-87 (Louis P. Pojman ed., 1994) (collecting leading articles on the ethics of preservation of species and natural objects).

133. *Cf. supra* notes 124-27 and accompanying text.

Suppose that the number of surviving *Homo sapiens* from World War III were approximately 100,000 individuals scattered in a few isolated urban nuclear bomb shelters on three continents. Humans would rightly assess the moral dilemma of increasing both the habitat and the number of *Homo sapiens* as giving rise to a priority for habitat expansion (through detoxification programs and the like in areas of contamination by nuclear fallout). Assuming whole-body cloning technologies survived the war scenario, humans would tend not to view cloning as a first-order strategy of biodiversity; however, this might be the case if the remaining global *Homo sapiens* survivors numbered around 100.

Moreover, looked at from the perspective of *other* non-endangered animal species, the human act of cloning competing, albeit endangered, animals is problematic in Darwinian terms: to be cloned would tend to disrupt the evolutionary process of inclusive fitness and survival of the fittest,[134] while creating unknown consequences on ecosystems as a whole.[135]

5. Closely related to the moral argument regarding the justness of human respect for animals[136] is the prudential argument that most animals are part of a web of relationships including a sexual relationship between a male member of the species and a female member of the species that results in offspring. An animal clone would be different in that it would not represent the union of a male and female, but would come from one or the other.[137] The consequences could greatly affect the sense of who we think the animal is in the future (i.e., part of God's wild universe or a human creation) as well as the sense of who we are (i.e., members of the biological community or overlords).[138]

V. CONCLUSION

As I finished writing this piece, the *New York Times* ran a front-page article about emerging elitist attitudes toward the Dolly-type of whole-organism cloning, which has been the focus of my Article.[139] The *New York Times* article was shocking to me, and I suspect to others, but we must resign ourselves to living in a state of "future shock" as social, scientific, and cultural change continues to accelerate at a geometric rate.[140]

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134. Cohen, *supra* note 102, at 1330.

135. *See supra* notes 67-83.

136. *See supra* notes 132-33 and accompanying text.

137. *See supra* notes 61-66 and accompanying text.

138. *Compare Meilaender Testifies About Human Cloning in Washington, D.C.*, 13 VALPO 2 (Spring 1997), *with* Aldo Leopold, *A Sand County Almanac* 202-05, 214-17, 220 (1970), *in* ROGER W. FINDLEY & DANIEL A. FARBER, ENVIRONMENTAL LAW 1-4 (4th ed. 1995).

139. Gina Kolata, *On Cloning Humans, "Never" Turns Swiftly into "Why Not,"* N.Y. TIMES, Dec. 2, 1997, at A1.

140. *See generally* ALVIN TOFFLER, FUTURE SHOCK (1970).

The guts of the *New York Times* report is as follows:

> Just nine months have passed since an astonished world got its first glimpse of Dolly the lamb, the first animal cloned from a cell taken from an adult. It was a feat that science had declared impossible.
>
> In the hubbub that ensued, scientist and ethicist after ethicist declared that Dolly should not conjure up fears of a Brave New World. There would be no interest in using the technology to clone people, they said.
>
> They are already being proved wrong. There has been an enormous change in attitudes in just a few months; scientists have become sanguine about the notion of cloning and, in particular, cloning a human being.
>
> Some infertility centers that said last spring [1997] they would never clone now say they are considering it. A handful of fertility centers are conducting experiments with human eggs that lay the groundwork for cloning. Moreover, the Federal Government is supporting new research on the cloning of monkeys, encouraging scientists to perfect technologies that could easily be transferred to humans. Ultimately, scientists expect cloning to be combined with genetic enhancement, adding genes to give desired traits, which was the fundamental reason cloning was studied in animal research.
>
> . . . .
>
> [N]ew reproductive arrangements [according to fertility experts tend to] pass through several predictable stages, from "horrified negation" to "negation without horror" to "slow and gradual curiosity, study, evaluation, and finally a very slow but steady acceptance."[141]

But why is this purported social process of acceptance for "new reproductive arrangements" happening so quickly with regard to cloning? Is this acceptance really happening or is it the hype of special interest groups in our society? If elite opinion makers are so ready to clone human beings, are there any legal, ethical, or policy issues left to discuss with regard to endangered animal species? I leave the reader to draw her own conclusions on these matters.

141. Kolata, *supra* note 139, at 1, 17 (selective internal quotations omitted).

These weighty matters bring to mind two separate poetic insights which I recast in professorial terms as final (or perhaps beginning) Socratic questions:

- Is it true that

The greatest beauty
is organic wholeness,
the wholeness of life and things, the divine beauty of the universe [?][142]

- Is it true

[That] [l]ife-biomass . . . is stored information; [that] living matter is stored information in the cells and in the genes . . . [?] [That] [t]here is more information of a higher order of sophistication and complexity stored in a few square yards of forest than there is in all the libraries of mankind[?] [That] [o]bviously, that is a different order of information[?] [That] [i]t is the information of the universe we live in[?] [That] [i]t is the information that has been flowing for millions of years[?] [That] [i]n this total information context, man may not be necessarily the highest or most interesting product[?][143]

142. Robinson Jeffers, *The Answer*, *in* THE EARTH SPEAKS 136 (Steve Van Matre & Bill Weiler eds., 1983).

143. GARY SNYDER, TURTLE ISLAND 107-08 (1974).