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DÉJÀ VU ALL OVER AGAIN: WHAT TO DO WHEN THE OCTOGENARIAN REALLY IS FERTILE AND OTHER LEGAL CONUNDRUMS WHICH WILL RESULT FROM THE CLONING OF HUMAN BEINGS

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INTRODUCTION

I must begin with a confession. Despite many hours of diligent work during my first semester of law school, I have mentally misplaced the detailed (and hard-won) knowledge I once possessed concerning the intricate workings of The Rule Against Perpetuities. I have not, however, forgotten the fertile octogenarian, the unborn widow, and the other hypothetical situations which the professor used to demonstrate the subtle operation of that ancient and venerable doctrine. Indeed, a recent television news story concerning the technical feasibility of cloning human beings has motivated me to reconsider the hypothetical situations, albeit in a new light.

Cloning animals is scientific fact.¹ Cloning human beings is scientific possibility.² Despite the current rules in many states and countries that forbid cloning human beings,³ the much greater expense which will

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1. See Maia Weinstock, *Send in the Clones*, SCI. WORLD, Oct. 19, 1998, at 7 (discussing the technique used to clone fifty mice from one original mouse); Laura Tangley, *Carbon-Copy Cows*, U.S. NEWS & WORLD REP., Dec. 21, 1998, at 55 (indicating that sheep, mice, and cows have been cloned using the cells of adult animals).

2. See H.R. REP. NO. 105-239, pt. 1, at 2 (1997) (recognizing that “the . . . cloning [of ‘Dolly’] raised the prospect of a similar procedure for humans.”). In addition, many articles cited in this Article are premised on the possibility of cloning human beings. Whether the cloning of a human being already has occurred depends upon one’s definition of cloning. If, as I contend it should, the definition of cloning includes embryo splitting, then the cloning of human beings already has been accomplished in the laboratory. When writers, legislators, and the general public envision cloning, however, they appear to define it—at least implicitly—as the production of a born alive genetic twin of an adult human being. No reliable report of this event exists. For a discussion of alternative definitions of cloning and of cloning techniques, see *infra* Part I.

3. A number of issues and controversies are raised by the various proposed and enacted regulatory schemes. See generally 1 CLONING HUMAN BEINGS: REPORT AND RECOMMENDATIONS OF THE NATIONAL BIOETHICS ADVISORY COMMISSION at i-v (1997) [hereinafter CLONING HUMAN BEINGS] (summarizing the ethical, legal, and policy considerations of human cloning in two volumes); Lori B. Andrews, *The Current and Future Legal Status of Cloning*, in 2 CLONING HUMAN BEINGS, at F-1, F-18-36 (describing existing and proposed state and federal cloning regulations); Jennifer Cannon & Michelle Haas, *The Human Cloning Prohibition Act: Did Congress Go Too*

Far?, 35 HARV. J. ON LEGIS. 637, 639-43 (1998) (describing the events surrounding the then-proposed Human Cloning Prohibition Act); Jason T. Corsover, *The Logical Next Step? An International Perspective on the Issues of Human Cloning and Genetic Technology*, 4 ILSA J. INT'L & COMP. L. 697, 715-56 (1998) (discussing existing and proposed legislation around the world); Charlene Kalebic, *The Constitutional Question of Cloning Humans: Duplication or Procreation? An Examination of the Constitutional Right to Procreate*, S. CAL. INTERDISC. L.J. 229, 237-245 (1998) (analyzing the constitutionality of proposed state and federal regulation of cloning); M. Cathleen Kaveny, *Cloning and Positive Liberty*, 13 NOTRE DAME J.L. ETHICS & PUB. POL'Y 15, 17-26 (1999) (describing the probable shortcomings of a laissez-faire attitude towards cloning and emerging reproductive technologies); Anne Lawton, *The Frankenstein Controversy: The Constitutionality of a Federal Ban on Cloning*, 87 KY. L.J. 277, 331-55 (1999) (framing the cloning issue in the context of "personal privacy" and speculating on the United States Supreme Court's likely approach to resolving the "right" to clone); Matthew M. Merrill, *The Sheep Heard 'Round the World: Legislation vs. Self-Regulation of Human Cloning*, 7 KAN. J.L. & PUB. POL'Y 169, 185 (1998) (concluding a "non-legislative, self-imposed moratorium by scientific and medical communities" is the proper approach, at least until a thorough public debate has been completed); Elizabeth C. Price, *Does the FDA Have Authority to Regulate Human Cloning?*, 11 HARV. J.L. & TECH. 619, 629-42 (1998) (analyzing whether the Food and Drug Administration has statutory authority to regulate human cloning); John A. Robertson, *Liberty, Identity, and Human Cloning*, 76 TEX. L. REV. 1371, 1433-53 (1998) (discussing public policy concerns involved in the cloning of human beings); Kimberly M. Jackson, Comment, *Well, Hello Dolly! The Advent of Cloning Legislation and Its Constitutional Implications*, 52 SMU L. REV. 283, 302-03 (1999) (making the case for continued cloning research with reasonable regulation); Paul Tully, Comment, *Dollywood is Not Just a Theme Park in Tennessee Anymore: Unwarranted Prohibitory Human Cloning Legislation and Policy Guidelines for a Regulatory Approach to Cloning*, 31 J. MARSHALL L. REV. 1385, 1414-21 (1998) (proposing policy recommendations to guide lawmakers); Lawrence Wu, Note, *Family Planning Through Human Cloning: Is There a Fundamental Right?*, 98 COLUM. L. REV. 1461, 1473 (1998) (asserting "that married persons have a fundamental right to procreate through the use of cloning technology.").

The most complete congressional look at cloning appears to be H.R. REP. NO. 105-239, published on August 1, 1997, as an examination of the Human Cloning Research Prohibition Act. See H.R. 922, 105th Cong. (1997). The Committee on Science recommended that the bill, which would have prohibited the expenditure of Federal funds to conduct or support research on the cloning of humans, be passed with minor amendment. Section 2 of the bill stated:

(a) Prohibition. None of the funds made available in any Federal law may be obligated or expended to conduct or support any project of research that includes the use of human somatic cell nuclear transfer technology to produce an embryo.

(b) Definitions. For purposes of this section

(1) the term "human somatic cell nuclear transfer" means transferring the nucleus of a human somatic cell into an oocyte from which the nucleus has been removed or rendered inert; and

(2) the term "somatic cell" means a cell of an embryo, fetus, child, or adult which is not and will not become a sperm or egg cell.

H.R. 922, 105th Cong. § 2 (1997). Section 4 of the Act would have protected various forms of scientific research, and stated in relevant part:

Nothing in this Act shall restrict other areas of scientific research not specifically prohibited by this Act, including important and promising work that involves-

(1) the use of somatic cell nuclear transfer or other cloning technologies to clone molecules, DNA, cells other than human embryo cells, or tissues; or

(2) the use of somatic cell nuclear transfer techniques to create animals other than humans.

H.R. 922, 105th Cong. § 4 (1997).

be involved in cloning a human being versus creating a human being the “old-fashion way,”⁴ and the likelihood that the “old-fashion way” of creating human beings will continue to enjoy a certain attractiveness, the cloning of human beings will occur.⁵ The relevant questions are when, where, how, and by whom?⁶

All can agree that the cloning of human beings will raise ethical concerns.⁷ All can agree that the threshold legal issue regarding the

4. See, e.g., Mary Midgley, *Double Trouble: Even if We Could Clone Human Beings*, THE GUARDIAN (London), Feb. 25, 1997, at 15, available in 1997 WL 2367848 (“Existing ways of producing more people are much cheaper and more reliable than anything in the laboratory.”).

5. See generally, Ronald Bailey, *The Twin Paradox: What Exactly is Wrong with Cloning People?*, REASON, May 1, 1997, at 52 (“There’s no reason to think that a law against cloning would make much difference anyway. ‘It’s such a simple technology, it won’t be ban-able,’ says [Baylor Professor of Medicine H. Tristram] Engelhardt. ‘That’s why God made offshore islands, so that anybody who wants to do it can have it done.’”); Midgley, *supra* note 4, at 15 (“Existing ways of producing people are far cheaper and more reliable than cloning. Research into cloning will nevertheless be particularly attractive to funding agencies. This is because any topic which touches on a primitive fantasy that carries a strong suggestion of magic creates great public excitement.”); Virginia Morell, *A Clone of One’s Own*, DISCOVER, May 1998, at 82, 84. Morell notes:

Human cloning . . . will happen . . . far sooner than one would have guessed before Dolly trotted onto the world’s stage. “It’s no longer in the realm of science fiction,” says Lee Silver, a Princeton geneticist and the author of *Remaking Eden*, a book about cloning and other reproductive technologies. “The technological breakthrough has already happened, although the details of how to do this with human cells still need to be worked out. Once they’re refined, it’ll be just a matter of time.”

Id.

6. See Morell, *supra* note 5, at 88 (“Despite the difficulties, says [St. Barnabas Medical Center embryologist Steen] Willadsen, ‘the technique will be—is being—perfected’ . . . somewhere. And once that happens, it’s only a matter of time before we see the first cloned humans . . .”). A number of scientists have announced plans to clone a human being or announced that they have already succeeded in doing so. See Michael A. Goldman, *Human Cloning: Science Fact and Fiction*, 8 S. CAL. INTERDISC. L.J. 103 (1998) (discussing the intention of physicist Richard Seed to clone a human being); *Did South Koreans Clone a Human?*, U.S. NEWS & WORLD REP., Dec. 28, 1998-Jan. 4, 1999, at 10 (reporting the claims of South Korean scientists); Steve Farrar & David Lloyd, *Rebel Baby Maker Plans the First Human Clone*, THE SUNDAY TIMES (London), Oct. 25, 1998, available in LEXIS, News Group File, The Times and Sunday Times (UK) File (discussing the claims of embryologist Severino Antinori).

7. This Article does not deal with the ethical considerations involved with cloning human beings. Those considerations are extensively covered in the literature, however. See, e.g., 2 CLONING HUMAN BEINGS, *supra* note 3, at D-49-51 (citing sources); *Symposium on Human Cloning: Legal, Social, and Moral Perspectives for the Twenty-First Century*, 27 HOFSTRA L. REV. 473 (1999); *Cloning Symposium*, 38 JURIMETRICS J. 1 (1997); *Symposium, Cloning Humans: Dangerous, Unjustifiable & Genuinely Immoral*, 32 VAL. U. L. REV. 633 (1998); *Symposium, The Future of Human Cloning: Prescient Lessons from Medical Ethics Past*, 8 S. CAL. INTERDISC. L.J. 167 (1998); Philip G. Peters, Jr., *Harming Future Persons: Obligations to the Children of Reproductive Technology*, 8 S. CAL. INTERDISC. L.J. 375, 383-389 (1999) (discussing concepts of harm and identifying harm to future children); M.A. Roberts, *Cloning and Harming: Children, Future Persons, and the “Best Interest” Test*, 13 NOTRE DAME J.L. ETHICS & PUB. POL’Y 37, 43-56 (1999) (discussing the legal and moral significance of whether cloning causes harm); Robertson, *supra* note 3, at 1404-33 (discussing the fears and reality of human cloning); Karen H. Rothenberg, *Being Human: Cloning and the Challenges for Public Policy*, 27 HOFSTRA L. REV. 639, 644-47 (1999) (examining a large number of ethical and practical issues which are raised by human cloning, but practical issues which are less concrete than those raised in the hypothetical situations set forth in this Article); Morell, *supra* note 5, at 88 (examining such problems as whether “damage from aging

cloning of human beings is whether the practice should be permitted.⁸ And all also should be able to agree that when cloning human beings occurs—whether widespread⁹ or not, or lawful or not—a number of novel legal issues will need to be addressed. Rather than adopting a reactive approach, as was common with the use of surrogate mothers and *in vitro* fertilization, the legal community should be proactive and begin now to consider and to debate the range of cloning-related legal issues. This should include addressing issues related to both the permissibility of cloning human beings *and* issues resulting from the presence of cloned individuals in the everyday economic and social world. This Article is concerned only with the latter set of legal issues.

Part I contains a brief introduction to cloning. The introduction is intended to aid the reader in understanding cloning techniques and the unique attributes of each method by which the cloning of a human being might occur. In Part II, hypothetical situations are used to demonstrate the legal issues which cloning will raise. Just as the fertile octogenarian and unborn widow were designed to demonstrate the somewhat unusual applications of The Rule Against Perpetuities, the hypothetical situations in Part II are designed to demonstrate the sometimes exotic and peculiar¹⁰ legal issues that will be raised by the cloning of human beings.¹¹

DNA may be passed on to the cloned infant”); Oliver Morton, *First Dolly, Now Headless Tadpoles*, SCIENCE, Oct. 31, 1997, at 798 (describing the British reaction to the “cloning” of Dolly); Joe Queenan, *Cloning? I Don't Think So. (The Dangers of Cloning Celebrities)*, PLAYBOY, Sep. 1997, at 60 (providing a satirical—and scary—look at cloning celebrities such as John Tesh and Adam Sandler); Harold T. Shapiro, *Ethical and Policy Issues of Human Cloning*, SCIENCE, July 11, 1997, at 195, 195 (summarizing the National Bioethics Advisory Commission's report on human cloning); Wray Herbert et al., *The World After Cloning*, U.S. NEWS & WORLD REP., March 10, 1997, at 59, 61-62 (discussing, among a variety of ethical and practical topics, the positions regarding the cloning of human beings taken by several major religious groups).

8. This Article neither concerns nor discusses current or proposed regulatory schemes regarding the cloning of human beings. For references to literature dealing with those topics, see the sources cited *supra* note 3.

9. Research into human cloning will continue, and the cloning of human beings is almost certain. However, the frequency with which human beings will be cloned is impossible to forecast. First, the old-fashioned method of creating human beings will continue to enjoy considerable popularity, if only because of the parents' desire to create children who share both parents' genes. Second, the cost of cloning, at least in the foreseeable future, will be prohibitive. Third, the increasing sophistication of other reproductive technologies will present individuals with less costly reproductive alternatives.

10. I intentionally have included hypothetical situations that some individuals will undoubtedly consider to be patently absurd, capable of easy resolution, or both. I decided to include these hypothetical situations because history suggests that attorneys will make almost any argument, no matter how absurd, in the absence of contrary case, statutory, or regulatory authority. I believe, therefore, that all of the hypothetical situations eventually will have to be addressed—at least once—by a court, statute, or regulation.

11. This Article's purpose is to spark debate by providing specific examples of the legal issues that will be raised by the cloning of human beings. This Article is not intended to provide suggested resolutions for each issue; there are far too many issues, and, with the exception of the most patently absurd issues, each issue is worthy of a full law review article. On several occasions, however, I use

I. A PRIMER ON CLONING¹²

Cloning refers to an assortment of artificial processes by which one or more genetically identical¹³ genes,¹⁴ cells, groups of cells, whole

a footnote to comment on some aspect of a legal issue that I find particularly interesting or compelling.

12. The title for Part I is derived from Michael P. Roberts, *A Primer of Genetic Engineering II: Gene Cloning*, 3 DICK. J. ENVTL. L. & POL'Y 11' (1994). An understanding of the legal problems which cloning human beings will create requires that the reader have at least a basic understanding of genetics and cloning procedures. "Basic understanding" is the key phrase, and the discussion in Part I fulfills the need. The material in Part I is derived from sources of varying levels of complexity. To promote readability, I have not provided specific citations regarding matters which I judge to be "common knowledge" among those who are versed in the technical aspects of genetics and cloning. Rather, I simply state that Part I represents an amalgam of material obtained from the following sources: RICHARD DAWKINS, *THE SELFISH GENE* (n.ed. 1989) (discussing the nature of genes, chromosomes, and their impact on human development, as well as the possible relationship between an individual's genetic makeup and predisposition towards certain types of emotions, thoughts, and behaviors); Goldman, *supra* note 6 (discussing the nature, history, techniques, and potential uses—including as a reproductive technology—of cloning); Morell, *supra* note 5 (discussing one researcher's efforts to clone a monkey); Rothenberg, *supra* note 7 (discussing the elements of adult cell cloning and the resulting challenge to the definition of human); Thomas A. Shannon, *Cloning Myths: Time to Take Thought*, COMMONWEALTH, Apr. 10, 1998, at 10 (noting the confusion created by the popular media through the use of imprecise cloning terminology); Shapiro, *supra* note 7 (describing somatic cell nuclear transfer); 1 CLONING HUMAN BEINGS, *supra* note 3, at 13-33 (discussing the methodologies employed in cloning). Of course, I provide specific citations to quotations and to information which I do not deem to be "common knowledge" amongst the group of writers to which I have just referred.

13. Whether a clone truly is genetically identical depends upon the specific cloning technique that is used. It is fair to say that by all but the most exacting standards any method of cloning will produce a clone genetically identical to the original. However, when dealing with the cloning of certain organisms, including human beings, particular cloning techniques may result in slightly different genetic material being present in the clone than was present in the cloned organism. As Herbert et al., point out:

Even biologically, a clone [produced using certain cloning techniques] would not be identical to the "master copy." The clone's cells, for example, would have energy-processing machinery (mitochondria) that came from the egg donor, [who may] not [be the same person as the person who donated] the nucleus [of the cell, which contains the overwhelming majority of genetic material]. But most of the physical differences between originals and copies wouldn't be detectable without a molecular-biology lab. The one possible exception is fertility.

Herbert et al., *supra* note 7, at 60.

14. "Gene cloning" is:

The production of a population of multiple copies of a DNA fragment. Cloning involves the isolation of a fragment of DNA from a chromosome and the copying of the fragment. The fragment of interest will usually code for a gene, such as the gene for cystic fibrosis, or will be closely linked to a gene of interest.

The cloned fragment has several uses. If the cloned fragment codes for the gene, itself, the clone can be used to identify the gene's product. Identifying the gene's product assists in the study of disease. Additionally, the cloned gene can be placed in another individual (this activity is called genetic transformation). The individual receiving the cloned DNA is called transgenic. Finally, the fragment can be used as a probe to determine if a given individual in a population carries the gene.

Jeffrey L. Gellner & Wendy L. Weaver, *A Glossary of Genetic Terms*, 3 DICK. J. ENVTL. L. & POL'Y 119, 124 (1994). See 1 CLONING HUMAN BEINGS, *supra* note 3, at A-3 ("Molecular cloning: the process whereby identical fragments of DNA are produced by insertion of a DNA fragment into a host vector followed by amplification to produce many thousands of copies in a host cell, usually a bacterium."). See also Mary K. Howett, *A Primer of Genetic Engineering III: Identification and*

plants, or whole organisms are created.¹⁵ This Article examines only the situations in which, and the techniques by which, whole human organisms might be cloned.¹⁶

Human cells contain genetic¹⁷ information comprising DNA.¹⁸ The totality of the DNA contained in a cell is the individual's genotype.¹⁹

Manipulation of Genes in Humans, 3 DICK. J. ENVTL. L. & POL'Y 17 (1994) (discussing, among other topics, gene cloning). Roberts describes the process as follows:

When a molecular biologist talks about cloning, he or she is generally referring to 'gene' cloning. Gene cloning is the isolation of a gene or a DNA fragment and the clonal propagation of that fragment as a recombinant DNA molecule.

This is not the same as cloning organisms. So there's a distinction to be made between cloning organisms . . . and cloning genes. In gene cloning, the goal is the production of genetically identical recombinant DNA molecules.

Roberts, *supra* note 12, at 11. For a discussion of what constitutes a "gene," see *infra* note 17 and accompanying text.

15. See Goldman, *supra* note 6, at 104. Goldman provides the following definition:

The term cloning finds broad meaning in biology. In its most general sense, cloning is the production of a number of genetically identical cells or *organisms*, whether they are the cells of my hand, a pair of identical twins, human cells grown in culture, bacterial cells grown in culture, or a field of dandelions.

Id. (emphasis added); 1 CLONING HUMAN BEINGS, *supra* note 3, A-1 ("Clone: A precise copy of a molecule, cell, or individual plant or animal."). Shannon also notes:

[T]hree distinct types of cloning—gene cloning, cellular cloning, and whole-organism cloning—have sometimes been fused in media coverage, leading to widespread confusion. Gene cloning multiplies identical copies of various genes; cellular cloning, a more complicated technique, replicates whole cells; and whole-organism cloning—the most complicated—reproduces whole organisms.

Shannon, *supra* note 12, at 10.

16. Organism cloning using the genetic material from an adult animal is the latest scientific breakthrough, and it is the scientific breakthrough which makes realistic the possibility of cloning an entire human being from genetic material supplied by an adult human being. Shannon notes:

Gene and cell cloning are well-established, standard biotechnical research methods and must be distinguished and discussed separately from organism cloning. Organism cloning, a la Dolly, signaled a dramatic scientific breakthrough because Dolly's cloning was accomplished with cells that were six years old and fully differentiated. The common wisdom until then was that such cells could not be reprogrammed to generate a new being.

Shannon, *supra* note 12, at 10. See generally Roberts, *supra* note 12, at 11 (discussing the cloning of genes, but touching on, and distinguishing, the cloning of organisms). To reiterate the point made in footnote 2, if embryo splitting falls within the definition of cloning, then the events surrounding the creation of Dolly merely make possible the cloning of adult human beings as opposed to the already possible cloning of human beings through embryo splitting.

17. The use of "genetic information" begs the issue of what constitutes a "gene." As the definition of a legal term may differ depending upon the context (e.g., substantive "due process" versus procedural "due process"), the definition of "gene" depends upon the perspective of the scientist who is providing the definition. It is fair to assert that those scientists who focus on discrete pieces of genetic information and their impact in individual human beings use a narrower definition of gene than do scientists who deal with questions concerning evolutionary trends and species-wide changes in population gene frequency. Several representative, and different, definitions of "gene" follow. Gellner and Weaver state that: "[t]he simplest definition [of "gene"] is the basic unit of inheritance, or heredity. Alternately, a gene is a particular sequence of nucleotides along a molecule of DNA that represents a functional unit of inheritance. Genes determine the heritable characters observed in the phenotype of an individual." Gellner & Weaver, *supra* note 14, at 124. See also 1 CLONING HUMAN BEINGS, *supra* note 3, at A-2 ("Gene: a working subunit of DNA. Each of the body's 100,000 genes carries the instructions that allow the cell to make one specific product such as a protein."). Richard Dawkins, who looks at genes at an evolutionary level, offers several definitions

“Genes are found in chromosomes, which, in turn, are found in the nuclei of cells. It is a simplification, though a useful one . . . to think of the genes in a chromosome as arranged like beads on a string. Some species—including humans—have chromosomes in pairs. Such species are said to be *diploid*.”²⁰

of “gene.” See DAWKINS, *supra* note 12, at 11 (“I shall argue that the fundamental unit of selection, and therefore of self-interest, is not the species, nor the group, nor even, strictly, the individual. It is the gene, the unit of heredity.”). Dawkins writes that “[a] gene is defined as any portion of chromosomal material that potentially lasts for enough generations to serve as a unit of natural selection.” *Id.* at 28. However, Dawkins also notes that because “genes” do not work in isolation, they must be considered in a larger context for evolutionary purposes:

The manufacture of a body is a cooperative venture of such intricacy that it is almost impossible to disentangle the contribution of one gene from that of another. A given gene will have many different effects on quite different parts of the body. A given part of the body will be influenced by many genes, and the effect of any one gene depends on interaction with many others. Some genes act as master genes controlling the operation of a cluster of other genes.

Id. at 24. Arguments have been made that the definition of gene should include cellular material not normally thought of as genetic. See, e.g., ELLIOTT SOBER, *PHILOSOPHY OF BIOLOGY* 4 (1993). Sober notes:

[G]enes are found in chromosomes, which are located in the nuclei of cells. However, it has been known for some time that there are bodies outside the nuclei (in the *cytoplasm*) that can provide a mechanism of inheritance. *Mitochondria* influence [the physical expression of certain] traits, and the DNA they contain is inherited. If a population changes its mitochondrial characters while its chromosomal features remain the same, is this an instance of evolution? Perhaps we should stretch the concept of the gene to include extrachromosomal factors.

Id. (citation omitted).

18. DNA is shorthand for deoxyribonucleic acid. DNA is:

The molecule that stores the “instructions” for development. DNA is comprised of two helical strands which are bound together by hydrogen bonds between pairs of nitrogenous bases. Each strand is a polymer (many copies of a monomer) of four nucleotides. Each nucleotide (the monomers) is comprised of one of four nitrogenous bases, the same deoxyribose sugar, and phosphoric acid. The specific sequence of nitrogenous bases determines which gene is present. Within each strand the nucleotides are bound together by phosphodiester links. That is, the ribose sugars of two adjacent nucleotides are bound together through a phosphate molecule.

Gellner & Weaver, *supra* note 14, at 122. See also 1 CLONING HUMAN BEINGS, *supra* note 3, at A-1 (“DNA: Deoxyribonucleic acid, found primarily in the nucleus of cells (some DNA is also found in the mitochondrion). DNA carries the instructions for making all the structures and materials the body needs to function.”).

19. See Gellner & Weaver, *supra* note 14, at 125 (A genotype is “[t]he particular assemblage of genes possessed by an individual. The effects of genotype and environment determine an individual [sic] phenotype.”). The difference between genotype and genome is that “[t]he entire list of possible gene locations is the genome. The entire combination of genes for a single individual is its specific genotype.” SOBER, *supra* note 17, at 4.

20. SOBER, *supra* note 17, at 2. See also Gellner & Weaver, *supra* note 14, at 121:

Chromosome: A single DNA molecule with its associated proteins, some of which are called histones. The structure of a chromosome has several levels. The DNA molecule, itself, is a double helix. In eukaryotic organisms, including humans, DNA is coiled around several histones to form nucleosomes. The nucleosomes are in turn folded among themselves to form a supercoiled molecule called a chromosome.

Id. The National Bioethics Advisory Commission provides the following definition:

Chromosomes: nucleic acid-protein structures in the nucleus of a cell. Chromosomes are composed chiefly of DNA, the carrier of hereditary information. Chromosomes contain genes, working subunits of DNA that carry the genetic code for specific proteins,

Broadly speaking, the DNA contained in an individual's genotype contains genetic information which accomplishes two functions. DNA instructs cells in the developing organism when and how to differentiate (i.e. develop in different ways) so as to produce skin, bone, muscle, organs, and all the other different types of cells required to form a human being.²¹ DNA also regulates the operation of numerous biochemical processes that occur in both a developing and a mature human being. By processes not fully understood, specific cells differentiate and specific bodily processes are regulated by accessing information located at, or being influenced by information located at, the relevant portion or portions of the DNA. For example, liver cells differentiate as a result of having access to, or being influenced by, only that part (or those parts) of the genotype which concerns the development of liver cells.

Richard Dawkins offers the metaphor of an architect's plans for the role of DNA and genes in the development of an individual organism:²²

A DNA molecule, which is part of an individual's genetic material, is itself made of a chain of building blocks, molecules called nucleotides.²³ A pair of nucleotide chains twists together into a double helix to form DNA.²⁴ Despite the complexity of the DNA molecules making up the genetic material, only four kinds of nucleotide building blocks make up DNA.²⁵ For convenience, the nucleotides are abbreviated as *A*²⁶, *T*,²⁷ *C*,²⁸ and *G*.²⁹ These four building blocks make up the genetic material in both plants and animals.³⁰

interspersed with large amounts of DNA of unknown function. A normal human somatic cell contains 46 chromosomes; a normal human germ cell contains 23 chromosomes.

1 CLONING HUMAN BEINGS, *supra* note 3, at A-1. Diploid refers to "a cell such as a somatic cell having two chromosome sets, as opposed to the haploid situation of eggs and sperm which have only one chromosome set." *Id.*

21. "Differentiation: the process whereby an unspecialized early embryonic cell acquires the features of a specialized cell such as a heart, liver, or muscle cell." 1 CLONING HUMAN BEINGS, *supra* note 3, at A-1.

22. The next several pages rely on Dawkins' metaphor, and they represent a mixture of paraphrase and quotation. To promote readability, I have written them as normal text. I hereby attribute the ideas and most of the wording to DAWKINS, *supra* note 12, at 22-23.

23. Gellner & Weaver, *supra* note 14, at 122.

24. DAWKINS, *supra* note 12, at 22.

25. *See id.*

26. "Adenine (A) [is o]ne of the four nitrogenous bases present in DNA. Adenine is a purine, as is guanine another one of the bases. In the DNA helix, adenine is always connected to, or 'paired' with, thymine by two hydrogen bonds." Gellner & Weaver, *supra* note 14, at 119.

27. "Thymine (T) [is o]ne of the four nitrogenous bases present in DNA. Thymine is a pyrimidine, as is cytosine another one of the bases. In the DNA helix thymine is always connected to, or 'paired' with, adenine by two hydrogen bonds." *Id.* at 130.

28. "Cytosine (C) [is o]ne of the four nitrogenous bases present in DNA. Cytosine is a pyrimidine, as is thymine another one of the bases. In the DNA helix cytosine is always connected to, or 'paired' with, guanine by three hydrogen bonds." *Id.* at 122.

The nucleotides that make up DNA are identical for plants and animals.³¹ An A nucleotide is identical in a person, a squirrel, and an oak tree.³² The differences between plants and animals, species of plants and animals, and individual members of particular species of plants and animals are the result of differences in the number, sequencing, and combinations of these building blocks.³³ Only identical twins (also identical triplets and quadruplets) have identical numbers, sequencing, and combinations of the building blocks.³⁴

With some minor exceptions (mainly gametes: eggs and sperm),³⁵ every cell in a person's body contains a complete and identical copy of his or her individual DNA.³⁶ The DNA is a set of instructions for construction and operation of a particular body, written in a unique combination of the A, T, C, and G nucleotides.³⁷

Dawkins' metaphor illustrates the point:

It is as though, in every room of a gigantic building, there was a bookcase containing the architect's plans for the entire building. The "book-case" in a cell is called the nucleus.³⁸ The architect's plans³⁹ run to 46 volumes in man—the number is different in other species. The "volumes" are called chromosomes. They are visible under a microscope as long threads, and the genes are strung out along them in order.⁴⁰

The pages of the volumes represent genes, which contain specific instructions.⁴¹

29. "Guanine (G) [is o]ne of the four nitrogenous bases present in DNA. Guanine is a purine, as is adenine another one of the bases. In the DNA helix guanine is always connected to, or "paired" with, cytosine by three hydrogen bonds." *Id.* at 125.

30. See DAWKINS, *supra* note 12, at 22.

31. See *id.*

32. See *id.* at 21.

33. See *id.* at 22.

34. See *id.*

35. See 1 CLONING HUMAN BEINGS, *supra* note 3, at A-2 ("Gamete: a mature sperm or egg cell.").

36. See DAWKINS, *supra* note 12, at 22.

37. See *id.*

38. The nucleus is that part of a cell in which the chromosomes are located. See 1 CLONING HUMAN BEINGS, *supra* note 3, at A-3 ("Nucleus: the cell structure that houses the chromosomes, and thus the genes.").

39. Dawkins states that: "[T]here is of course no 'architect.' The DNA instructions have been assembled by natural selection." DAWKINS, *supra* note 12, at 23. Of course, the existence of an "architect" and whether the DNA instructions have been assembled by natural selection alone or natural selection aided by an "architect" are ontological questions which are far beyond the scope of this Article.

40. *Id.* at 22.

41. See *id.* Dawkins actually states that: "'Page' will provisionally be used interchangeably with gene, although the division between genes is less clear-cut than the division between the pages of a book." *Id.*

Once a person reaches physical maturity, he possesses one hundred trillion cells.⁴² All these cells originated from a single cell, which was given a single “master copy” of the architect’s plans.⁴³ As this original cell divided, each subsequent cell received its own copy of the architect’s plans.⁴⁴ From these plans, a person’s body (the building)⁴⁵ is constructed.⁴⁶

In human sexual reproduction, each parent contributes a part of the DNA/architectural plans. The parts fuse to produce the unique combination of genetic material that constitutes the genotype (the architect’s plan) contained in the fertilized⁴⁷ egg.⁴⁸ “The normal chromosomal constitution in humans is two sets of twenty-three chromosomes for a total

42. *See id.* at 23.

43. *See id.*

44. Mistakes in copying undoubtedly occur along the way. As a result, not every cell has a completely identical set of genetic information. However, the number of copying errors is so small that it is permissible to state that with the exception of a few cells (e.g., gametes), all the cells in a person’s body possess identical genetic information, an identical set of the architect’s plans. The process of cell division is described as:

The mechanism by which a single cell divides into two daughter cells. Cell division is the final stage of a cell’s life. The normal cell cycle, or life, is divided into four phases. During the first phase, named Gap 1, the cell grows in preparation for the Synthesis phase. During the Synthesis phase the chromosomal material is duplicated (DNA is synthesized). The cell then prepares for nuclear division during the Gap 2 phase. During Mitosis, the final phase, the doubled chromosomal material divides followed by division of the whole cell. The consequence of the doubling and subsequent division is that each daughter cell receives the same amount of chromosomal material as the mother cell.

Gellner & Weaver, *supra* note 14, at 120.

45. The specific methodology by which DNA builds and operates the body is not completely understood. For the interested reader, however, I include Dawkins’ explanation:

It is one thing to speak of the duplications of DNA. But if the DNA is really a set of plans for building a body, how are the plans put into practice? How are they translated into the fabric of the body? This brings me to the second important thing DNA does. It indirectly supervises the manufacture of a different kind of molecule—protein. . . . The coded message of the DNA, written in the four-letter nucleotide alphabet, is translated into a simple mechanical way into another alphabet. This is the alphabet of amino acids which spells out protein molecules.

Making proteins may seem a far cry from making a body, but it is the first small step in that direction. Proteins not only constitute much of the physical fabric of the body; they also exert sensitive control over all the chemical processes inside the cell, selectively turning them on and off at precise times and in precise places. Exactly how this eventually leads to the development of a baby is a story which will take decades, perhaps centuries, for embryologists to work out. But it is a fact that it does. Genes do indirectly control the manufacture of bodies. . . .

DAWKINS, *supra* note 12, at 23.

46. *See id.* In one respect, Dawkins’ metaphor seems inadequate for our purposes. Although it explains the development of the body, it does not directly recognize the role of DNA in regulating the on-going operation, maintenance, and reconstruction and repair of the body. Thus, I would amend the metaphor to include the observation that the pages in the architect’s plans also include instructions concerning how to operate, maintain, and repair the building. This amendment is consistent with Dawkins’ observation that DNA, operating through proteins, “exert[s] sensitive control over all the chemical processes inside the cell, selectively turning them on and off at precise times and in precise places.” *Id.*

47. “Fertilization [is] the process whereby male and female gametes unite; it begins when a sperm contacts the outside of the egg and ends with the formation of the zygote.” 1 CLONING HUMAN BEINGS, *supra* note 3, at A-2.

48. *See id.* at A-2 (“Egg: the mature female germ cell; also call ovum, or oocyte.”).

of forty-six chromosomes. One set is donated from the mother, and the other set is donated by the father."⁴⁹

As the fertilized human egg divides, the first eight cells are undifferentiated; that is, they are identical and unspecialized.⁵⁰ If one of the cells splits off from the others, it is capable of growing into a genetically identical twin.⁵¹ After a group of cells reaches eight in number, the cells begin to differentiate and parts of the architectural plans contained in each cell cease to be accessible to or to influence the development of that cell and its daughter cells. In adult human beings, cells are highly differentiated.⁵² As a result, all but a small portion of the DNA in the cell has been rendered "off limits" and has no impact on the development and operation of the cell. It is as if most of the volumes of architectural plans have been locked or the pages glued together.⁵³

This discussion suggests that two general methods of cloning organisms are theoretically possible.⁵⁴ The first method is called "embryo

49. Gellner & Weaver, *supra* note 14, at 121; Sober describes the process, albeit a bit unromantically, as follows:

Now I come to sex. This is a common but by no means universal mode of reproduction. A diploid organism forms *gametes*, which contain just one of the two chromosomes that occur in each chromosomal pair: The gametes are haploid [that is, they have their chromosomes as singletons]. The process by which diploid parents produce haploid gametes is called *meiosis*. . . . The nonsex cells (somatic cells) in an individual are genetically identical with each other (ignoring for the moment the infrequent occurrence of mutations), but the gametes that an individual produces may be immensely different because the individual is heterozygous at various loci. Diploid parents produce haploid gametes, which come together in reproduction to form a diploid offspring.

SOBER, *supra* note 17, at 2-3.

50. See, e.g., Morell, *supra* note 5, at 86 ("Sheep, calves, monkeys, and humans all reach the eight-cell stage before they start differentiating . . ."); 1 CLONING HUMAN BEINGS, *supra* note 3, at 23 ("In mammals, unlike many other species, the early embryo rapidly activates its genes and cannot survive on the components stored in the egg. The time at which embryonic gene activation occurs varies between species—the late 2-cell stage in mice, the 4-8 cell stage in humans, and the 8-16 cell stage in sheep.") (citations omitted).

51. These cells are "totipotent." See 1 CLONING HUMAN BEINGS, *supra* note 3, at A-3 ("Totipotent: having unlimited developmental capacity. The totipotent cells of the very early embryo have the capacity to differentiate into extraembryonic membranes and tissues, the embryo, and all postembryonic tissues and organs.")

52. Depending upon the time in the development process in which they are removed, cells which are taken from embryos for use in somatic nuclear transfer may not be fully differentiated. See generally 1 CLONING HUMAN BEINGS, *supra* note 3, at 13-22 (presenting an overview of the history of scientific inquiry into cellular characteristics and processes which progresses from early investigations into the properties of cells through the cloning of Dolly).

53. See *id.* at 17. The National Bioethics Advisory Commission provides this description: Nearly every cell contains a spheroid organelle called the nucleus which houses nearly all the genes of the organism. Genes are composed of DNA, which serve as a set of instructions to the cell to produce particular proteins. Although all somatic cells contain the same genes in the nucleus, the particular genes that are activated vary by the type of cell. For example, a differentiated somatic cell, such as a neuron, must keep a set of neural-specific genes active and silence those genes specific to the development and functioning of other types of cells such as muscle or liver cells.

Id.

54. See *id.* at 15 ("[Another] type of cloning aims to reproduce genetically identical animals. Cloning of animals can typically be divided into two distinct processes, *blastomere separation* and

splitting” or “embryonic cloning” or “blastomere separation.”⁵⁵ This method involves the creation of one genetically identical copy or more than one genetically identical copies of an organism from an egg which was fertilized through sexual reproduction, albeit *in vitro*.⁵⁶ As this

nuclear transplantation cloning.) (emphasis added). A blastomere is “each of the cells produced when the fertilized egg cleaves into 2, then 4, 8, and 16 cells.” *Id.* at A-1. Some writers have limited their definition of cloning to nuclear transplantation cloning. See, e.g., Josie Glausiusz, *Splitting Heirs*, DISCOVER, Jan. 1994, at 84, 84:

True cloning implies reproduction without sex. It would mean creating an exact copy of an adult human—by taking a single cell from that person, placing it inside a human egg cell that has had its own genes and indeed its entire nucleus removed, and allowing that single cell to grow into a new adult as a normal embryo would.

Id. In addition, the proposed federal regulations reproduced *supra* note 3, and the state statutes reproduced *infra* note 63, focus on nuclear transplantation cloning. I adopt the definition of cloning used by the National Bioethics Advisory Commission, *supra*, which I believe represents the more prevalent view among scientists. In addition, if cloning is defined as the creation of (nearly) genetically identical individuals through artificial processes, then both embryo splitting/blastomere separation and nuclear transplantation procedures constitute cloning.

55. An embryo is “the developing organism from the time of fertilization until significant differentiation has occurred, when the organism becomes known as a fetus.” 1 CLONING HUMAN BEINGS, *supra* note 3, at A-2. A blastomere is “each of the cells produced when the fertilized egg cleaves into 2, then 4, 8, and 16 cells.” *Id.* at A-1.

56. See generally Rothenberg, *supra* note 7 (discussing embryonic cloning, among other topics, and referring to real-world examples of embryo splitting performed in the laboratory). Rothenberg describes the process of embryo splitting as follows:

Unlike the adult cell cloning technique used by Dr. Wilmut and his colleagues, embryo splitting uses as its “raw material” an embryo, rather than an adult cell. In embryo splitting, clusters of cells of very early embryos are separated and grown into individual embryos. Cells at this state have not yet begun to differentiate into specific tissues, such as bone or muscle, and therefore carry their full genetic complement for development. Each separated embryo may therefore be implanted and carried to term. In effect, embryo splitting is an *in vitro* replica of the natural process by which identical twins are created.

Embryo splitting does not share . . . three features of adult cell cloning . . . First, embryo splitting requires human embryos which must have been created by the fertilization of an egg by a sperm. Second, because only embryos are used, embryo splitting does not provide those involved with the same knowledge of an adult expression of the genetic material. Finally, embryo splitting can produce only a limited number of duplicates to the original.

Id. at 643. The National Bioethics Advisory Commission provides this description of embryo splitting:

In blastomere separation, the developing embryo is split very soon after fertilization when it is composed of two to eight cells . . . Each cell, called a blastomere, is able to produce a new individual organism. These blastomeres are considered to be totipotent, that is they possess the total potential to make an entire new organism. This totipotency allows scientists to split animal embryos into several cells to produce multiple organisms that are genetically identical.

1 CLONING HUMAN BEINGS, *supra* note 3, at 15. See also Glausiusz, *supra* note 54 (detailing the process of splitting human embryos in the laboratory). The following is a description of the methodology employed in scientists Jerry Hall and Robert Stillman’s successful attempt at cloning human embryos:

When one of those single-celled embryos divided into two cells, the first step in development, the scientists quickly separated the cells, creating two different embryos with the same genetic information. (This sometimes happens naturally inside a mother, and the result is identical twins.) In the process, though, the researchers had to strip away an outer coating, called the zona pellucida, that is essential to development. Then came the trickiest part of the procedure. Over the years, Hall had been working with a gel derived from seaweed that could serve as a substitute for the zona pellucida. When Hall

method begins with sexual reproduction, it involves the combination of the biological parents' different DNA. The "Original" is an "unknown entity" in the sense that there is no way to know what the adult will look like and act like if the fertilized egg were permitted to develop to term and the resulting infant were raised to adulthood.⁵⁷

Cloning at this early stage of development presents several possibilities. A fertilized egg could be permitted to divide until there were, say, six cells. A scientist could then remove one cell (Copy #1), two separate cells (Copy #1 and Copy #2), or more separate cells, permitting each one to develop to fruition on its own after implantation into the uterus of the woman or women who will carry the clones to term. The Original, the fertilized egg, would directly result in one or more copies.

Another procedure would permit the fertilized egg to divide until there were, say, two cells. A scientist could then remove one cell (Copy #1) and let it divide until there were, say, four cells. A scientist could then remove one cell (Copy #2), two cells (Copy #2 and Copy #3), or more separate cells, permitting each one to develop to fruition on its own. The Original (the fertilized egg) would directly yield one copy (Copy #1), which itself would be copied in a second generation (Copy #2 or more).

Finally, copies of copies of copies might be made. For example, a fertilized egg could be permitted to divide until there were, say, two cells. A scientist could then remove one cell (Copy #1) and let it divide until there were, say, two cells. The scientist could then remove one cell (Copy #2), which would be permitted to divide until it reached the two-cell stage, at which time another cell would be removed and permitted to develop into a two-cell group (Copy #3), and so on.⁵⁸

put the artificial coating around the cloned embryos, they began to grow and develop. The experiment was a success.

The scientists replicated their procedure many times, producing forty-eight clones in all. Philip Elmer-Dewitt, *Cloning: Where Do We Draw The Line?*, TIME, Nov. 8, 1993, at 64, 66.

57. See, e.g., Goldman, *supra* note 6, at 112. Goldman notes:

The production of twins, or higher multiple births, by splitting embryos is a simple extension of the natural process of twinning. The individuals produced are genetic replicas of one another, not the genetic replicas of living (or dead) adults. But in embryo splitting, the exact genetic nature of the source embryo—the embryo that was split—represents the same roll of the dice we see in any traditional new birth.

Id. It might be possible to discover a great deal about the probable physical phenotype of the adult if one of the cells were removed and its DNA were analyzed. See generally VICTOR A. MCKUSICK, MENDELIAN INHERITANCE IN MAN (10th ed. 1992) (listing and discussing known genetically-linked phenotypes); Aubrey Milunsky, *The "New" Genetics: From Research to Reality*, 27 SUFFOLK U. L. REV. 1307 (1993) (discussing the nature and frequency of genetic disorders). However, without this process, the physical phenotype of the adult would be just as speculative as the old-fashioned method of imagining the combination of the two parents' DNA.

58. Cloning from the original through embryo splitting, however, cannot go on indefinitely in this manner. As Morell writes:

You might expect that geneticists could divide each embryo into eight blastomeres, wait for each blastomere to grow into an eight-cell embryo, and repeat the process

The second general method of cloning, known as "somatic nuclear transfer" or "nuclear transplantation cloning,"⁵⁹ involves the use of cells which are partially or fully differentiated, that is, cells from an embryo in which cells have begun to differentiate or cells from an adult. The theoretical difficulty for whole-organism cloning is that with partially differentiated cells part of the genotype is thought to be inaccessible to, or to no longer be capable of influencing the development of, subsequent cell division and operation.⁶⁰ Thus, an attempt to create a whole organism

indefinitely. But that's not possible, says Wolf, because the embryo's cells begin differentiating into limbs and organs after a certain amount of time has passed since its development began, regardless of how many cells it has. An embryo grown from a blastomere will have only an eighth as many cells to work with as an entire embryo; if you divided it again, it would have only a sixty-fourth as many cells."As development proceeds, when time for it to differentiate arrives, it doesn't have enough cells for the job," says Wolf, and even a blastomere will be less viable than an entire embryo. Because the cues to develop come from the cell's cytoplasm—the material that fills the cell—rather than the nucleus, the blastomere's clock can be reset by transferring its genetic material to a new egg full of fresh cytoplasm.

Id. The numerical limits of embryo splitting have not been established. And, one supposes, whatever limitations initially exist might be overcome, at least to some extent, as scientific processes become more advanced. It also is possible that the limitations discussed in this paragraph could be overcome through cytoplasm transfer. See Karen Wright & Sarah Richardson, *Human in the Age of Mechanical Reproduction*, DISCOVER, May, 1998, at 74, 80. Wright and Richardson providing the following definition: Cytoplasmic transfer: The cytoplasm—the material in a cell that surrounds the nucleus—is extracted from a younger woman's egg and inserted into an older woman's egg. Cytoplasm from a young egg may reduce errors in the genetic material of the older woman's egg, enhancing the chance of successful fertilization. *Id.*

59. See 1 CLONING HUMAN BEINGS, *supra* note 3, at A-3 ("Nuclear transplantation cloning: a type of cloning in which the nucleus from a diploid cell is fused with an egg from which the nucleus has been removed. The DNA of the transplanted nucleus thus directs the development of the resulting embryo."). The National Bioethics Advisory Commission also defines "somatic cell nuclear transfer" as the technique "of nuclear transplantation using nuclei derived from somatic cells other than those of an embryo or fetus." *Id.* at 1.

60. See Morell, *supra* note 5, at 85. Morell describes the problem as follows:

Before Dolly, researchers thought that adult cells could not be induced to produce a clone because they are already differentiated. As a fertilized egg develops into an adult, it divides into two, then four, then eight identical cells. Soon, however, the cells begin to specialize, becoming bone or skin, nerve or tissue. These differentiated cells all share the same DNA—the blueprint of the body—but they follow different parts of the instructions it contains. "In a sense, they're programmed," says Wolf, and as they age, it becomes more and more difficult to reprogram them, to make them switch functions. That's exactly what the Scottish team did when they produced Dolly: they took the genetic material from a differentiated adult cell and made it behave like the genetic material in a newly fertilized egg. Their success, however, does not mean that it is now easy to reprogram a human adult cell. If anything, notes Wolf, researchers suspect that every species is unique in its requirements for setting its cellular clock back to zero.

Id. Confirmation of the importance of Dolly's existence comes from the description of the National Bioethics Advisory Commission:

The new development in the experiments that Wilmut and colleagues carried out to produce Dolly was the use of much more developed somatic cells isolated from adult sheep as the source of the donor nuclei. This achievement of gestation and live birth of a sheep using an adult cell donor nucleus was stunning evidence that cell differentiation and specialization are reversible. Given the fact that cells develop and divide after fertilization and differentiate into specific tissue (e.g., muscle, bone, neurons), the development of a viable adult sheep from a differentiated adult cell nucleus provided surprising evidence that the pattern of gene expression can be reprogrammed. Until this

from such cells would fail because the full range of required cells could not be created.⁶¹ The process of somatic nuclear transfer, however, apparently has made possible the use of differentiated cells.⁶² Attempts to prohibit the cloning of human beings have focused on this method, as embryo splitting could be seen, at least in limited numbers, as a legitimate technique for increasing the chance of success in *in vitro* fertilization.⁶³

experiment many biologists believed that reactivation of the genetic material of mammalian somatic cells would not be complete enough to allow for the production of a viable adult mammal from nuclear transfer cloning.

1 CLONING HUMAN BEINGS, *supra* note 3, at 16. See generally Goldman, *supra* note 6 (discussing the history of cloning research); 1 CLONING HUMAN BEINGS, *supra* note 7, at 16-22 (presenting an overview of the history of scientific inquiry into cellular characteristics and processes which progresses from early investigations into the properties of cells through the cloning of Dolly).

61. As the discussion suggests, one other obstacle stands in the way of either type of cloning: at the current stage of technological development, a womb must be available to carry the cloned organism to term. The references in this Article to the use of wombs to bring clones to term should not be misconstrued either as a indication that I am unaware of the ethical concerns surrounding the use of surrogate mothers or that I believe women are mere baby factories.

62. Somatic cells are cells which have begun to differentiate or which have completed the process of differentiation. See 1 CLONING HUMAN BEINGS, *supra* note 3, at 1 n.1 ("A somatic cell is any cell of the embryo, fetus, child, or adult which contains a full complement of two sets of chromosomes; in contrast with a germ cell, i.e., an egg or a sperm, which contains only one set of chromosomes.").

63. Some states have undertaken to ban the cloning of human beings, although cloning tends to be defined as involving the procedure of somatic nuclear transfer. For example, California statutory law provides:

Cloning of human beings; purchase of ovum, zygote, embryo, or fetus for cloning human beings prohibited

(a) No person shall clone a human being.

(b) No person shall purchase or sell an ovum, zygote, embryo, or fetus for the purpose of cloning a human being.

(c) For purposes of this section, "clone" means the practice of creating or attempting to create a human being by transferring the nucleus from a human cell from whatever source into a human egg cell from which the nucleus has been removed for the purpose of, or to implant, the resulting product to initiate a pregnancy that could result in the birth of a human being.

CAL. HEALTH & SAFETY CODE § 24185 (1999). As another example, Michigan statutory law provides:

Prohibition of human cloning; exceptions; penalties; right of action; definition

(1) A licensee or registrant shall not engage in or attempt to engage in human cloning.

....

(5) As used in this section:

(a) "Human cloning" means the use of human somatic cell nuclear transfer technology to produce a human embryo.

(b) "Human embryo" means a human egg cell with a full genetic composition capable of differentiating and maturing into a complete human being.

(c) "Human somatic cell" means a cell of a developing or fully developed human being that is not and will not become a sperm or egg cell.

(d) "Human somatic cell nuclear transfer" means transferring the nucleus of a human somatic cell into an egg cell from which the nucleus has been removed or rendered inert.

MICH. COMP. LAWS. § 333.16274 (1999).

Rhode Island has a particularly sophisticated definitional and conceptual structure in its statutory scheme, and it is worthy of quotation. The statute begins by noting the contributions made by certain forms of genetic and cellular cloning:

Whereas, recent medical and technological advances have had tremendous benefit to patients, and society as a whole, and biomedical research for the purpose of scientific

Somatic nuclear transfer involves the removal of the DNA-laden nucleus⁶⁴ from an oocyte (an unfertilized egg),⁶⁵ which results in an enu-

investigation of disease or cure of a disease or illness should be preserved and protected and not be impeded by regulations involving the cloning of an entire human being; and

Whereas, molecular biology, involving human cells, genes, tissues, and organs, has been used to meet medical needs globally for twenty (20) years, and has proved a powerful tool in the search for cures, leading to effective medicines to treat cystic fibrosis, diabetes, heart attack, stroke, hemophilia, and HIV/AIDS;

The purpose of this legislation is to place a ban on the creation of a human being through division of a blastocyst, zygote, or embryo or somatic cell nuclear transfer, and to protect the citizens of the state from potential abuse deriving from cloning technologies. This ban is not intended to apply to the cloning of human cells, genes, tissues, or organs that would not result in the replication of an entire human being. Nor is this ban intended to apply to in vitro fertilization, the administration of fertility enhancing drugs, or other medical procedures used to assist a woman in becoming or remaining pregnant, so long as that procedure is not specifically intended to result in the gestation or birth of a child who is genetically identical to another conceptus, embryo, fetus, or human being, living or dead.

R.I. GEN. LAWS § 23-16.4-1 (1998). The statute goes on to state:

(a) No person or entity shall utilize somatic cell nuclear transfer for the purpose of initiating or attempting to initiate a human pregnancy nor shall any person create genetically identical human beings by dividing a blastocyst, zygote, or embryo.

(b) Definitions.

(1) "Somatic cell nuclear transfer" means transferring the nucleus of a human somatic cell into an oocyte from which the nucleus has been removed;

(2) "Somatic cell" means any cell of a conceptus, embryo, fetus, child, or adult not biologically determined to become a germ cell;

(3) "Oocyte" means the female germ cell, the egg; and

(4) "Nucleus" means the cell structure that houses the chromosomes, and thus the genes.

(c) Protected research and practices.

(1) Nothing in this section shall be construed to restrict areas of biomedical, microbiological, and agricultural research or practices not expressly prohibited in this section, including research or practices that involve the use of:

(i) Somatic cell nuclear transfer or other cloning technologies to clone molecules, DNA, cells, and tissues; or

(ii) Mitochondrial, cytoplasmic, or gene therapy; or

(iii) Somatic cell nuclear transfer techniques to create animals.

(2) Nothing in this section shall be construed to prohibit:

(i) In vitro fertilization, the administration of fertility-enhancing drugs, or other medical procedures used to assist a woman in becoming or remaining pregnant, so long as that pregnancy is not specifically intended to result in the production of a child who is genetically identical to another human being, living or dead;

(ii) Any activity or procedure that results, directly or indirectly in two or more natural identical twins.

R.I. GEN. LAWS § 23-16.4-2 (1998).

Some definitions of cloning are more general. *See, e.g.*, the Missouri law which states:

No state funds shall be used for research with respect to the cloning of a human person. For purposes of this section, the term "cloning" means the replication of a human person by taking a cell with genetic material and cultivating such cell through the egg, embryo, fetal and newborn stages of development into a new human person.

MO. ANN. § 1.217 (1999). A review of the summaries of bills introduced into Congress and into the various state legislatures indicates numerous attempts to ban cloning. The summaries also indicate that cloning frequently is defined as somatic nuclear transfer, rather than being defined more broadly to include embryo splitting. However, taken together, the bills summaries reveal a desire by the various sponsoring legislators to outlaw the range of cloning techniques.

64. *See* Gellner & Weaver, *supra* note 14, at 127 (the nucleus of a cell is that part of the cell in human beings that "contains the chromosomes. The nucleus is bound by a membrane."). The removal of the nucleus "leaves the cytoplasm—that is, the egg's membrane and the material that once surrounded its chromosomes." Morell, *supra* note 5, at 87 (although the author was speaking of the

cleated egg.⁶⁶ The DNA, which was removed, is then replaced with the nucleus of a somatic cell (a body cell, a differentiated cell).⁶⁷ When done in the proper fashion,⁶⁸ this process results in a Copy that is genetically identical to the Original.⁶⁹

procedure being performed on rhesus monkeys, the language is appropriate for human beings, as well).

65. See 1 CLONING HUMAN BEINGS, *supra* note 3, at A-3 (“Oocyte: the mature female germ cell; the egg.”).

66. See *id.* at A-2 (“Enucleated egg: an egg from which the nucleus has been removed.”).

67. Somatic cells are “[a]ll cells that are not germline, egg, or sperm cells.” Gellner & Weaver, *supra* note 14, at 129. A germline cell is “[a]n ancestral cell to any cell that develops into the gametes, that is, the egg and sperm cells.” *Id.* at 125.

68. The placement into the enucleated egg of the nucleus of the somatic cell may be accomplished through a variety of specific methods. In general, two methods may be used. First, once removed from the somatic cell the nucleus may be injected directly into the enucleated egg. See generally Weinstock, *supra* note 1, at 7 (describing a technique in which the nucleus from a somatic cell was removed and injected into an enucleated egg, which was then chemically stimulated to develop). Second, the egg and the somatic cell may be induced to fuse through the use of electrofusion. Nuclear transfer through electrofusion has been described as follows:

Recent experiments have used nuclear transfer into enucleated unfertilized eggs

Using these very early stage eggs prolongs the period of possible reprogramming before the donor nucleus has to undergo the first division. And the advent in the last few years of electrofusion for both fusion of cells and activation of the egg has been another major advance, because activation and fusion occur simultaneously. Because these experiments use fusion of two cells and not simple injection of an isolated nucleus, all of the cellular components are transferred. Thus, the mitochondria, which contain some genes of their own, are transferred along with the nucleus. Because an enucleated egg also contains *viva* mitochondria, the result of a fusion experiment is a cell with a mixture of mitochondria from both the donor and the recipient. Since the mitochondrial genes represent an extremely small proportion of the total number of mammalian genes, mixing of mitochondria *per se* is not expected to have any major effects on the cell. However, if the nucleus donor suffers from a mitochondrial disease, and the egg donor does not, then the mixture of the mitochondria may significantly alleviate the disease.

1 CLONING HUMAN BEINGS, *supra* note 3, at 19-20.

69. See 1 CLONING HUMAN BEINGS, *supra* note 3, at 13 (stating that cloning results in “a genetic twin” of the original from which the differentiated somatic cell has been taken). “Proper fashion” as used in the text should be taken in context. In somatic nuclear transfers, the nuclear DNA is transferred into an unfertilized egg. If the nuclear DNA is derived from a man or from a woman other than the woman donating the unfertilized egg, there will be small difference in the DNA possessed by the Original (the donor of the nuclear DNA) and the Copy. The non-nuclear contents of the unfertilized egg contain small amounts of DNA material; if the unfertilized egg does not come from the Original (which always must be the case when the Original is a man), then these bits of DNA will be slightly different than those contained in the non-nuclear material in the Original. See SOBER, *supra* note 17, at 4. Sober notes:

[G]enes are found in chromosomes, which are located in the nuclei of cells. However, it has been known for some time that there are bodies outside the nuclei (in the *cytoplasm*) that can provide a mechanism of inheritance. *Mitochondria* influence various phenotypic traits, and the DNA they contain is inherited. If a population changes its mitochondrial characters while its chromosomal features remain the same, is this an instance of evolution? Perhaps we should stretch the concept of the gene to include extrachromosomal factors.

Id. (citations omitted). See also 1 CLONING HUMAN BEINGS, *supra* note 3, at A-2 (“Mitochondrion: A cellular organelle that provides energy to the cell. The mitochondrion contains some of its own genes.”).

The procedural difficulty has been to find some way to prepare the somatic cell in order that the full complement of DNA would be available to the cloned organism. As one writer described the process:

[The scientists who cloned Dolly] introduced the idea of starving the donor cells to arrest the nucleus in a state thought to be more compatible with life in the egg cytoplasm.⁷⁰ Thus "synchronized," the donor cell is fused to an egg whose own nucleus has been removed, and development begins.⁷¹ This staging of the donor nucleus is the technical innovation that made "Dolly" possible.

In cloning "Dolly," Wilmut and colleagues removed the nucleus from the egg of a sheep (the recipient oocyte) and inserted the nucleus obtained from a mitotically arrested somatic cell derived from the udder of another adult sheep (the DNA donor animal), and successfully reared a lamb—Dolly—that was the younger identical twin of the donor animal. From a detached scientific perspective, the Wilmut team's accomplishment was nothing short of a miracle. Cloning a mammal from an adult cell was thought to be impossible, or, at the very least, decades away. It is now clear to developmental biologists that the mammalian genome⁷² undergoes no irreversible changes during development and can be "reset" to its ground state. Mammalian cloning, with the birth of Dolly, moved out of the domain of science fiction and into the realm of the possible.⁷³

70. Cytoplasm is "the cellular material within the plasma membrane which contains the organelles but excluding the nucleus which contains the chromosomes." Gellner & Weaver, *supra* note 14, at 121; 1 CLONING HUMAN BEINGS, *supra* note 3, at A-1 ("Cytoplasm: the contents of a cell other than the nucleus. Cytoplasm consists of a fluid containing numerous structures that carry out essential cell functions.")

71. Rothenberg reports the method of fusing as follows:

Dr. Wilmut's Dolly was cloned using an adult cell. News reports state that in Dr. Wilmut's technique, a spark of electricity causes an adult cell to fuse with an unfertilized egg from which the nucleus had previously been removed. Molecules in this egg then program genes in the adult cell to produce an embryo. The embryo is implanted into a surrogate mother and brought to term. The resulting offspring is a clone of the adult cell donor. It is thought that the cloning of humans may be possible through use of the same technique.

Rothenberg, *supra* note 7, at 641.

72. The genome is "the complete genetic makeup of a cell or organism." 1 CLONING HUMAN BEINGS, *supra* note 3, at A-2.

73. The success in cloning Dolly was the result of tremendously difficult work punctuated by many more failures than the one success. As Goldman describes the ordeal:

The Dolly experiment began with 277 oocytes, 247 of which were fertilized to produce twenty-nine early embryos that were implanted into thirteen surrogate mothers. The end result was one single successful live birth. The low success rate, unimpressive in scientific terms, has been called "an anecdote, not a result" by Sgaramella and Zinder. These authors noted that there is no definitive proof that Dolly is in fact a clone from a somatic cell of the donor rather than from a stray embryonic cell in the donor (she was pregnant at the time the cells were taken). I do not think that we have been completely misled by accounts of the Dolly clone, but at least one of the objections raised by Sgaramella and Zinder is serious: If the donor cell was an embryonic cell from Dolly's

Cloning which is accomplished by embryo splitting results in copies that are genetically identical to the original. Cloning by somatic nuclear transfer results in copies containing identical nuclear DNA to the original, but possessing whatever subtle differences that result from the particular chemistry and attributes of the unfertilized egg into which the DNA was introduced.⁷⁴ Somatic nuclear transfer may be used to begin the growth of cells that then could be induced to produce identical copies through embryonic splitting.⁷⁵ Somatic nuclear transfer also could be used to create clones from clones.⁷⁶

Without regard to how the growth of a copy is initiated, genetically identical copies will develop with slightly different physical phenotypes.⁷⁷ Identical original phenotypes of human beings will not

DNA parent, then Dolly is really a clone of the fetus, not the adult. Embryonic cells as a source for donor nuclei have been used successfully for some time, and the successful use of these cells would not be scientifically very startling. Moreover, if Dolly was cloned from an embryonic cell, she is certainly not the living proof that cloning from adult cells is possible.

Goldman, *supra* note 6, at 106-07. Even Goldman notes that “[m]any of the claimed repetitions of the Dolly experiment actually involve either embryo splitting . . . or somatic nuclear transfer using embryonic rather than adult cells.” *Id.* at 107, n.12. Goldman states that he believes:

[I]t is more likely that Dolly arose from the nucleus of an adult “stem cell.” These are cells that are relatively undifferentiated, so the scientific accomplishment is not as exciting as it would be if a fully differentiated donor cell were involved. However, the practical meaning is unchanged; it would still mean that we can rear an exact genetic duplicate of an adult.

Id. at 107 n.13. *Cf.* Shapiro, *supra* note 7, at 195 (describing the cloning of Dolly as involving “a new technique that had never before been fully successful in mammals. The technique involved transplanting the genetic material of an adult sheep, apparently obtained from a well-differentiated somatic cell, into an egg from which the nucleus had been removed.”); 1 CLONING HUMAN BEINGS, *supra* note 3, at 1 (indicating that the cloning of Dolly had “demonstrat[ed] that nuclei from cells derived from an adult animal could be ‘reprogrammed’ or that the full genetic complement of such a cell could be reactivated well into the chronological life of the cell . . . [a feat which set] the results of th[e] experiment apart from prior work.”).

74. If both the egg and the nuclear DNA come from the same woman, then all of the DNA will derive from one person. Otherwise, the nuclear DNA will derive from the donor of the somatic cell and the non-nuclear DNA will derive from the donor of the enucleated egg.

75. See Goldman, *supra* note 6, at 112 n.19 (“The press and the public frequently confuse embryo splitting for cloning by somatic nuclear transfer. In fact, embryo splitting does not involve nuclear transfer and produces embryos that are identical to each other, not to a preexisting adult.”).

76. See Weinstock, *supra* note 1, at 7 (indicating that in mice cloned through somatic nuclear transfer, “clones of clones seemed to be just as healthy as the clones of normal mice.”).

77. The phenotype is the individual expression of a particular physical, emotional, or behavioral attribute. The phenotype is a combination of a genotype and environmental forces. It is for that reason that cloning will never produce more than superficially identical reproductions of the original genotype. Gellner and Weaver explain the concept of phenotype as follows: Phenotype [is t]he observed expression of a trait, or character, in an individual. Usually, the phenotype is determined, or influenced, by both an individual’s genes and the environment of the individual. Symbolically, this relationship can be expressed:

Phenotype = Genotype + Environment

An example of the interaction of genotype and environment to produce a phenotype is alcoholism. Assuming a genetic component exists for alcoholism, an individual may

develop identically even if they are raised in essentially an identical environment. In a gross sense, at a macro level, the neurophysiology, neurochemistry, and general biochemistry are hardwired. Thus, entities sharing a common genotype will share a common macro-level phenotype and will share phenotype-related attitudes, values, opinions, beliefs, predispositions, emotions, instincts, movements, and behaviors. At a micro level, however, the neurophysiology, neurochemistry, and general biochemistry are plastic. Different intellectual, physical, and social experiences will result in slightly different developments and hardwiring of the brain, the nervous system, and those phenotype-related chemical systems influencing attitudes, values, opinions, beliefs, predispositions, emotions, instincts, movements, and behaviors.

At least with respect to the cloning of human beings, while Nature converges, Nurture diverges. From the moment the organism's growth begins, differences in environmental factors will cause phenotypic divergence. If, for example, two copies are implanted in the same woman's womb, one copy may be implanted in a spot where it will receive slightly better nutrition. And, for example, if one copy is implanted into the uterus of a woman who eats highly nutritious food and does not smoke, drink, or take illicit drugs, the copy is likely to fare better than another copy which is implanted into a woman who eats junk food, smokes two

possess the genes for alcoholism but not express the disease if raised in an environment without access to alcohol. In such a situation an individual would not have the phenotype of alcoholism but would possess the genotype.

Gellner & Weaver, *supra* note 14, at 127. See also SOBER, *supra* note 17, at 2 (referring to the "phenotypes of organisms . . . [as] . . . their morphology, physiology, and behavior."). Sober also notes that differences between individuals' phenotypic "expression may be due to genetic factors, to environmental factors (such as nutrition), or to a combination of changes in genetic factors and changes in environmental factors." *Id.*

In common usage, we speak of cloning as making a copy of the original. For plants and for many non-human organisms, this may approximate reality. Cloning copies or reproduces the original's genotype. Except for minor variations caused by environmental factors, the genotype determines the physical manifestation of the organism, that is, its phenotype. In plants and in non-human living organisms in which perception, feeling, and behavior is essentially hard-wired, the phenotype or physical manifestation may produce an essentially identical copy. In anatomical, neuroanatomical, neurochemical, and general biochemical attributes, the original and the clone would be virtually indistinguishable from each other. However, even in this situation, the copy is physically separate and is developmentally distinct from the original. Even in this situation, we would not in common experience consider the entities to be the same entities. We would, however, consider the clone to be copies or essentially identical in all meaningful ways.

The situation is more problematic when human beings are involved. Take a naturally occurring process analogous to cloning: the development of identical twins or identical triplets. The process by which identical twins or identical triplets develop begins with the fertilization of an egg by sperm; instead of the fertilized egg developing into a single organism, an identical twin develops when an undifferentiated cell from the initial zygote splits off and begins developing on its own, and an identical triplet develops when an undifferentiated cell from one of the two original zygotes splits off and begins developing on its own. In such cases, barring mutation, the resulting zygotes share an identical genotype. Subject to in-development mutation, accident, and environment-related influences, the identical genotype will produce identical physical manifestations, that is, will produce identical original phenotypes.

packs of cigarettes and drinks a six-pack of beer every day. Further, even copies which received relatively similar intrauterine treatment may be subjected to different environmental conditions (nutrition, exercise, rest, etc.) after birth. Thus, initially identical genetic identity may nonetheless result in different phenotypic development.

Part I provided an introduction to genetics and cloning. Two types of cloning were examined: embryo splitting and somatic nuclear transfer. With this background on the feasibility and reality of cloning human beings, Part II will examine the legal issues that will arise as human clones take their place in society.

II. CLONING HYPOTHETICALS

The cloning of human beings will raise legal issues as many and as varied as there are situations in which, and motivations for which, cloning occurs. This part of the Article sets forth and discusses now-hypothetical cloning situations that may occur and that certainly would raise legal issues. The hypotheticals were created by thought experiments in which I imagined the use of a particular cloning technique and then imagined the clone in real-world situations.

Taken as a set, the hypothetical situations raise legal issues which fall into four categories; taken individually, a specific hypothetical may raise issues which fall into more than one category. The categories of issues are captured by the following questions:

- 1) Is there any situation in which Original and Copy⁷⁸ constitute one legal person, or do they always constitute two legal persons?
- 2) How should the relationship between the individual who provides the nuclear DNA and the clone be characterized? What should be the respective rights and responsibilities of the person who provides the nuclear DNA and of the clone?
- 3) How should the relationship between the clone and various third parties be characterized? What should be the respective rights and responsibilities of the clone and of various third parties?

78. The cloning of human beings will require either new terminology or the adaptation of old terminology to new situations. I will use "Original" as the proper name of the human being that provided the nuclear DNA. I will use "Copy" or "Copy" followed by a number to refer to clones of Original. See Herbert et al., *supra* note 7, at 61. Herbert et al., describe the issue as follows:

How would a human clone refer to the donor of its DNA? "Mom" is not right, because the woman or women who supplied the egg and the womb would more appropriately be called Mother. "Dad" isn't right, either. A traditional father supplies only half the DNA in an offspring. Judith Martin, etiquette's "Miss Manners," suggests, "Most honored sir or madame." Why? "One should always respect one's ancestors," she says, "regardless of what they did to bring one into the world." That still leaves some linguistic confusion. Michael Agnes, editorial director of Webster's New World Dictionary, says that "clonee" may sound like a good term, but it's too ambiguous. Instead, he prefers "original" and "copy." And above all else, advises Agnes, "Don't use 'Xerox.'"

4) How should the relationship between clones be characterized? What should be the respective rights and responsibilities of the clones towards each other?

A. *The Case of the Killed Clone*

Original clones herself using an enucleated egg that she provides.⁷⁹ Original raises Copy until Copy reaches the age of 22. At that time, Original becomes jealous of Copy's "youth" and, in a premeditated act, shoots Copy through the heart. Copy dies. Is Original's action murder, partial suicide, or partial self-mutilation?

Would a reversal of roles affect the outcome? Assume Copy became jealous of the success and position which Original had attained by virtue of Original's greater age, and, in a premeditated act, Copy shot Original through the heart. Original died. Would Copy's action be murder, partial suicide, or partial self-mutilation?

In the first situation, Original destroys a copy of Original's own DNA, a copy which she "created." May Original exercise such prerogative with respect to "her" unique genotype? Does Original's initial "possession" of the genotype give her complete control over the existence of any expression of the genotype, even an expression of the genotype which is fully-grown? Parental relationships based on sexual reproduction provide no direct guidance. The genetic relationship between Original and Copy is different from the genetic relationship between a parent and a child who is created by sexual reproduction. The child produced through sexual reproduction does not share an identical genotype with either parent; thus, a parent of a child created by sexual reproduction could never make a claim based on prior possession of a unique genotype.

The relationship between Original and Copy also is different than the relationship between identical twins.⁸⁰ Identical twins are born into a situation in which an identical genotype exists through a natural, albeit a rare, occurrence (a) not of their making and (b) which results in the twins gaining possession of the genotype at essentially the same time. The separate manifestations of the genotype is not the result of one person "artificially" creating another person who shares the same genotype; put

79. When the individual to be cloned is a man or is a woman who is incapable of carrying a child, a surrogate mother will have to be used." Surrogacy is unregulated on the federal level and remains subject to a confusing patchwork of state statutes and contract principles." Rothenberg, *supra* note 7, at 646. Rothenberg notes that cases have held that a surrogate mother is not a child's legal mother, *Johnson v. Calvert*, 851 P.2d 776, 786-87 (Cal. 1993), and that the guiding principle is not contract law, but the child's best interests, *In re Baby M*, 537 A.2d 1227, 1241-42 (N.J. 1988). Rothenberg also raises the legitimate question of whether "the particular features of adult cloning call for federal guidance?" Rothenberg, *supra* note 7, at 646.

80. Identical twins do not share an identical genotype with either parent. Therefore, neither parent could claim prerogative over the twins based on prior possession of the twins' genotype.

a different way, one twin cannot claim any type of prerogative over the other twin based on prior possession of the genotype.⁸¹

Assuming one concludes Original does have complete dominion over her unique nuclear DNA,⁸² would Original's ability to act be limited in the situation in which the enucleated egg from which Copy developed did not come from Original? Would the donation of an enucleated egg by a woman other than the Original give the donor of the egg some prerogative with respect to Copy's existence? On what grounds?

In the second situation, the situation in which Copy kills Original, Copy cannot claim dominion over a unique genotype by virtue of initial "possession." Further, Copy cannot claim that she created Original or in any manner gave physical expression to Copy's genotype. Although Copy might be seen as an extension or appendage of Original, the opposite cannot be true.

B. The Case of the Double's Troubles

The first hypothetical raised the issue of whether the person to first possess a genotype (Original) has the right to control the existence of person later created with her identical genotype (Copy). Are the rights of one person to control her genotype different when the issue is whether to permit the creation of a copy of a genotype rather than to terminate the existence of a copy of a genotype? Put in a more concrete manner: Does one identical twin have the right to veto (or somehow restrict) an act of cloning by the other identical twin? Two hypothetical situations demonstrate what might occur.

First hypothetical: Original 1 and Original 2 are identical twins. Original 1 wishes to clone herself using both an enucleated egg that she

81. The first-born and, thus, the "older" twin may argue that she has dominion over the genotype. Historically, the law has not accorded the older twin this right. In addition, there is no way to tell whether the "older" twin actually was the first to "possess" the genotype, that is, the twin who developed directly from the fertilized egg, rather than from a cell which split off from the cells which developed directly from the fertilized egg.

82. The purpose of this Article is to set forth hypothetical situations in order to promote discussion, not to provide "answers" to them. I feel compelled offer an opinion concerning the resolution of this hypothetical, however. A distinction must be drawn between Original's right to replicate her genotype and her right to control the actions and existence of the person who results from the replication of Original's genotype. If somatic nuclear transplantation is lawful, then Original has an affirmative right to replicate her genotype. However, precisely because the essence of cloning is the replication of a genotype, Original's decision to clone herself should act as a full and irrevocable grant to Copy of the right to possess and use that genotype. In addition to this quasi-property analysis, Copy's status as an entity to be accorded the full panoply of human rights is ensured by Copy's attributes as an organically independent, sentient being who possesses independent consciousness, independent moral decision-making ability, and independent attitudes, values, opinions, beliefs, emotions, and preferences. Both prior to and after Copy reaches the age of majority, Original should possess only those rights to control Copy's existence and activities that a parent should have to control the existence and activities of a child created by sexual reproduction.

will provide and one of her own somatic cells.⁸³ Original 2 seeks a court order enjoining Original 1 from cloning herself. Original 2 argues that she has an interest of some type that should prevail over Original 1's desire to clone herself.

Original 2 could argue that Original 1's act of cloning herself would be the same as forcing Original 2 to reproduce against her will.⁸⁴ Original 2 would have to concede that she would not be forced to engage in activities such as carrying Copy to term, giving birth to Copy, or raising Copy, all of which normally would be consequences of Original 2's decision to reproduce. However, Original 2 could argue that a core principle involved in the right to control one's reproduction is the right to control the propagation of one's genotype. Original 2 may feel it would profoundly violate her sense of individuality and distinctiveness for there to be another copy of her genotype in existence.⁸⁵ This right is brought into stark relief by the ability of Original 1 to clone herself. The right could not have been put to the test prior to the ability to clone an adult human being. Should the injunction be granted, particularly if Original 1 is willing and able to engage in successful sexual reproduction?

Second hypothetical: Original 1 and Original 2 are identical twins. Because of their identical genotype, both twins possess the physical attributes and innate musical abilities to develop world-class opera voices. However, when she was in college, Original 1 decided not to pursue a career in opera, a decision she now regrets. Original 2 studied and practiced diligently, and she achieved worldwide fame.

Original 1 realizes she will never be able to enjoy a career similar to the career enjoyed by Original 2. However, Original 1 desires to live vicariously through a clone possessed of similar talents and guided by Original 1 as the clone's "stage mother." Original 1 knows that a clone would come into her prime as a singer at just the time Original 2 would be retiring from singing. Original 1 believes a person with an appearance and a voice substantially identical to those possessed by the young Original 2 would be able to take advantage of the name recognition and "voice loyalty" which Original 2 has achieved. In addition to the emo-

83. Original 1 might desire to clone herself because she is unable or unwilling to engage in successful sexual reproduction or because she simply wants to bring a life into the world that is her genetic duplicate.

84. Of course, Original 1 likely would argue that denying her the right to clone herself would be the same as denying Original 1 an equally fundamental right: the right to control her reproductive decisions.

85. Original 2 would not be precluded from making this argument by the existence of Original 1. Original 2 may view Original 1's existence as "natural," unlike the existence of an "artificially produced" clone. Alternatively, Original 2 may not like that her unique identity is diminished by the presence of Original 1, but she may accept the situation as *fait accompli*; although law and morality prevent Original 2 from destroying the copy of her genotype, Original 2 may consider it to be an open question whether Original 1 may be prevented from producing another identical copy of the genotype.

tional satisfaction Original 1 hopes to enjoy from this imagined vicarious existence, Original 1 plans to serve as the clone's manager and to be compensated for that role. To fulfill her desires, Original 1 intends to clone herself using an enucleated egg provided by her and one of her own somatic cells.

Original 2 seeks a court order enjoining Original 1 from cloning herself. In addition to the argument that she possesses a privacy right to control the propagation of her genotype, Original 2 argues that she has a commercial property interest in the genotype possessed by the twins and that Original 1's act of cloning herself would be an infringement on that commercial interest. Original 2's direct commercial interest in her genotype is its ability to produce the phenotype of her physical appearance and voice.⁸⁶ In addition, Original 2 alleges she has an indirect interest in her genotype (and the resulting phenotype) because she has worked to turn the phenotype expression into a marketable commodity. Original 2 argues that any clone of Original 1 would be exploiting Original 2's name, voice, face, and good will. Should the injunction be granted, particularly if Original 1 is willing and able to engage in successful sexual reproduction?

C. *The Case of the Truly Fertile Octogenarian*

Original is eighty years old and is not capable of conceiving and bearing a child through sexual reproduction. Original has no living relatives. She has herself cloned using an enucleated egg from a woman who also serves as a surrogate mother.⁸⁷ The surrogate mother relinquishes custody of Copy to Original upon Copy's birth, and Original raises Copy with the help of a nanny. When Original is eighty-five-years-old and Copy is slightly over four years old, Original dies. What would happen in each of the following situations?

First hypothetical: Original had \$10,000,000 in an individual savings account at the time Original died. Would Copy have ownership of the account on the theory that Copy simply is a "younger" version of Original (i.e., a genotype identical to, and a phenotype similar to, Original at a

86. Although he was discussing protecting DNA information, the following statement indicates the protection already afforded to phenotypic expressions under the law.

State and federal circuit courts have extended the privacy right to encompass a variety of infringements against the particular manifestations of a person's identity besides the paradigm cases of unwarranted intrusions into his diary, personal records, or private behavior. Such infringements include expropriation of a person's name, photograph, or likeness; his signature; and his voice or even a likeness of his voice.

Hugh Miller, III, *DNA Blueprints, Personhood, and Genetic Privacy*, 8 HEALTH MATRIX 179, 188-89 (1998) (footnote omitted).

87. It might be possible to extract a viable unfertilized egg from Original. However, given Original's age, the use of an unfertilized egg from a surrogate mother is a more realistic possibility. The reader should consider whether the answers to the questions posed in this hypothetical would be altered should Original use one of her own unfertilized eggs and use a surrogate mother to carry Copy to term.

younger age)?⁸⁸ What if in the application for the account Original did not put a name but only a reference to an attached document which contained her complete genotype or a sufficient number of genetic markers that only a person who possessed the Original's exact nuclear genotype would be able to match the "name?"

By comparison, consider a much more common occurrence. When Original was thirty-five years old, she inherited \$250,000 when a rich aunt died. Original opened a savings account in her own name and deposited all of the money in the account. Original exercised restraint and did not withdraw any funds from the account. When Original is eighty-five, she decides to withdraw some of the funds. Fifty years have elapsed since the account was opened. Original (eighty-five years old) is genetically identical to the thirty-five-year old Original who opened the account. The eighty-five-year-old Original's phenotype (the physical expression of genetically influenced traits) is likely to be profoundly dissimilar to her phenotype at thirty-five. The attitudes, values, opinions, beliefs, emotions, preferences, and the like of the eighty-five-year-old Original are likely to be profoundly different than those of the thirty-five-year-old Original who opened the account. Indeed, both the physical phenotype and the mental and emotional attributes of the two versions of "Original" may be as different as between Original and Copy. However, the eighty-five-year-old Original would be entitled to the money. Why should the eighty-five-year-old Original receive the money from the account in this example? How is her situation similar to or different from the situation of Copy in the first hypothetical?

Second hypothetical: Original dies without a will. Would an estate be created? Without the operation of intestate succession would Copy own the assets that normally would comprise Original's "estate"?⁸⁹ If an estate would be created by Original's death, under existing intestate statutes would the assets of the estate pass to Copy? If so, what designation would Copy take? Would Copy be considered Original's twin (but much

88. The possibility of a person desiring to leave money to himself has been recognized. See Bailey, *supra* note 5, at 52. Bailey describes the issue:

What about a rich jerk who is so narcissistic that he wants to clone himself so that he can give all his wealth to himself? . . . Today, rich people, and regular people too, make an effort to pass along some wealth to their children when they die. People will their estates to their children not only because they are connected by bonds of love but also because they have genetic ties. The principle is no different for clones.

Id.

89. This hypothetical raises the issue of whether the Original-Copy relationship is sufficiently dissimilar from a parent-child or identical twin-identical twin relationship that a new property estate should be created. Like joint tenancy or tenancy in the entireties, the estate would permit the immediate passage of the property interest from Original to Copy upon Original's death. Unlike joint tenancy or tenancy in the entireties, Copy would not possess more than an inchoate interest in Original's property during Original's lifetime. This new interest might be called "genetic tenancy" or "genotypic tenancy."

younger) sister? daughter?⁹⁰ or simply a general family member based on genetic lineage?⁹¹ If Copy is permitted to take Original's assets directly, that is, without the assets passing through an estate, how would—or should—the assets be taxed? Does there need to be a separate estate tax when the recipient is a clone? If Copy is treated as the same being as Original for ownership purposes, what impact will this have on those individuals who otherwise might have been able to claim a share of the assets? Has a death occurred which requires Original's will to be probated? If Original had married, should her husband have the right to "elect against the will" if there is no need to probate the will?

Third hypothetical: Assume Original cloned herself when she was sixty, not eighty, years old. Assume, further, that twenty-five years later Copy kills Original in a premeditated manner. Finally, assume the relevant state possesses a statute that prohibits murderers from taking by intestate succession. Would Copy be permitted to take Original's estate? Would the killing of Original be murder, partial suicide, or partial self-mutilation?

Finally, is there any reason to consider Original and Copy to be one person for the purpose of wealth transfers at death even though one might not consider Original and Copy to be one individual for the purpose of Original exercising control over Copy's actions and existence?

D. *The Case of the Infant "Spouse"*

Original married Allen. The couple wants to have children, but Original is unable to conceive, either naturally or through *in vitro* fertilization. Original has herself cloned using one of her own enucleated eggs, and she carries Copy to term.⁹² From the moment of Copy's birth, Allen acted as her father, that is, Allen formed an emotional attachment to Copy, engaged in feeding, dressing, and cleaning Copy, and purchased items such as clothing, food, and diapers for Copy. Six months after de-

90. See Katherine R. Guzman, *Property, Progeny, Body Part: Assisted Reproduction and the Transfer of Wealth*, 31 U.C. DAVIS L. REV. 193 (1997) (discussing the inadequacy of current legal models when technology and other developments render it obsolete); Christine A. Djalleta, Comment, *A Twinkle in a Decedent's Eye: Proposed Amendments to the Uniform Probate Code in Light of New Reproductive Technology*, 67 TEMP. L. REV. 335, 354 (1994).

91. This hypothetical raises the issue of whether the Original-Copy relationship is sufficiently dissimilar from a parent-child relationship that a new category of inheritance would need to be created for statutes of intestate succession. The issue would not appear to be relevant if Copy were the only surviving family member. However, how should property be distributed if Original's husband were living? if children produced by sexual reproduction between Original and Original's husband were living, but Original's husband had died—either before or after Copy was created and born?

92. Other writers have suggested this scenario. See, e.g., Rothenberg, *supra* note 7, at 641 (discussing the implications of the situation in which "a child could be conceived and carried by one person. A woman could have one of her adult cells fused with one of her own unfertilized eggs from which the nucleus had been removed. The resulting embryo could be implanted in her womb and carried to term.").

livering Copy, Original dies. Allen has taken no steps to "adopt" Copy. Should Copy be considered to be Allen's wife? daughter? an in-law? or a complete stranger?⁹³

Notwithstanding any legal presumption which might exist that any child born during a marriage is the product of the marriage, this hypothetical clearly indicates that Copy has no biological ties to Allen. The method of "conception" is such that there would be little doubt that Copy is not genetically related to Allen.

Measured by genotype, Copy is identical to Original, Allen's deceased wife. Copy is not Allen's daughter in any biological sense. Although Copy was born into a situation in which Allen treated Copy as a daughter, Copy is biologically no more of a daughter than would be any infant found on Allen's doorstep, taken into the home, and raised by Allen. Should Allen be assumed as a matter of law to have parental responsibility for any clones created by Original during their marriage unless he seeks a court order freeing him from responsibility or takes some public action in which he repudiates the responsibility? Should Allen be free from parental responsibilities unless he specifically accepts them, either through court action or some form of public recognition (such as signing a birth certificate)? Should the action of caring for Copy constitute the basis for establishing a parental relationship, particularly since there would be no biological parent other than Original?

Should the treatment of Copy be any different if Copy were the result of somatic nuclear transfer using Original's enucleated egg and the DNA from Allen? Would Copy be Allen's twin (but much younger) brother? son? Copy certainly would be related biologically to Allen. Copy would be a product of the marriage in the sense that both partners would have contributed DNA to the initial cell which developed into Copy, although Allen's contribution to Copy's DNA would have been significantly greater than Original's contribution and would have been significantly greater than Original's contribution in traditional reproduction.⁹⁴

93. See *Id.* at 645. Rothenberg notes:

Adult cell cloning upsets our notion of familial relationships. Creation of a child by cloning requires the contribution of DNA material, an unfertilized egg, and a ready womb. What language will we use to describe this "family"? By what criteria will we determine the claim of parental status of each of the contributors to the cloning process?

Id. See also Bernadine Healy, *Ian Wilmut: Breaking The Clone Barrier*, TIME, Mar. 29, 1999, at 176, 176 ("What is the role of clones in society? Are they an asexual variant on incest? Can they become human slaves or organ donors? Who are their parents? Who is their family?").

94. Assuming that same-sex marriage is legalized, the question of parentage may be faced where one woman provides an unfertilized egg and the other woman provides the nuclear DNA. Is the resulting copy a daughter? Whose daughter?

E. *The Case of the Supportive Father*

Allen and Original are married. The couple is unable to conceive due to Allen's fertility problems. The couple decides against *in vitro* fertilization using a sperm donor. Instead, Original has herself cloned using one of her own unfertilized eggs, and she carries Copy to term. Allen takes no steps to adopt Copy, but treats Copy as his daughter. Five years later, Original divorces Allen. Does Allen have the same custody or visitation rights normally accorded to biological fathers? If Allen does not have a father's custody or visitation rights, should Allen be treated as Copy's father for the purpose of child support?

As in the previous hypothetical, notwithstanding any presumption that any child born during a marriage is the product of the marriage, Copy has no biological ties to Allen. Copy is not a daughter in any biological sense. Although Copy was born into a situation in which Allen treated Copy as a daughter, Copy is biologically no more of a daughter than any infant who found on Allen's doorstep. Should Allen be assumed, as a matter of law, to have parental responsibility for any clones created by Original during their marriage unless he seeks a court order freeing him from responsibility or takes some public action in which he repudiates the responsibility? Should Allen be free from parental responsibility unless he specifically accepts them, either through court action or some form of public recognition (such as signing a birth certificate)? Should the action of caring for Copy constitute the basis for establishing a parental relationship?

Again raising the questions from the previous hypothetical, should Allen's rights and responsibilities be any different if Copy was the product of somatic nuclear transfer using Original's enucleated egg and the DNA from Allen? Would Copy be Allen's (much younger) twin brother? Allen's son? Copy certainly would be related biologically to Allen. Copy would be a product of the marriage in the sense that both partners would have contributed to the initial cell which developed into Copy. Copy would be a product of the marriage in the sense that both partners would have contributed DNA to the initial cell which developed into Copy, although Allen's contribution to Copy's DNA would have been significantly greater than Original's contribution and would have been significantly greater than Original's normal contribution.

F. *The Case of the Child (?) Mistress*

Assume Allen and Original are married. Allen is a member of the armed services, and he is assigned to a one-year overseas mission. During this time—and without his knowledge (and, therefore, without his agreement)⁹⁵—Original has herself cloned using one of her own enucle-

95. The consent to which I refer is not the consent to Original's general decision to procreate. Nor do I refer to consent to terminate a pregnancy. Rather, I merely refer to Allen's agreement to

ated eggs, and she carries Copy to term. When Allen returns from his tour of duty, he is surprised by the presence of Copy. Consider your responses to the questions in the previous hypotheticals. Then consider whether your responses would be any different if—as in this situation—Copy had been created without Allen's knowledge or agreement?

Now, consider a variation on this hypothetical. Assume that prior to Allen's return, Original sends Copy to be raised by a college friend of Original who lives 2,000 miles away. Copy is raised by Original's friend as if Copy were the friend's own daughter. Allen is never told of Copy's existence. Copy is never told about either Allen or Original.

Twenty years later, Allen still has no knowledge of Copy's existence, and Allen and Original are still married. Through a twist of fate, Allen and Copy meet, fall in love, and have sexual relations. Is Allen committing adultery? Is Allen committing incest? With respect to whether Allen is committing adultery or incest, would—or should—it make any difference whether Allen knew that Copy was genetically related to Original?⁹⁶

G. *The Case of the Generational Clones*⁹⁷

Assume Original is unmarried. Original wants to raise several children, preferably children who are genetically related to her. Original also

participate in a venture which might give rise to Allen having a set of profound and long-term parental rights and, more to the point, responsibilities.

96. A variation of this hypothetical involves "The Case of the Unknowing Cloning." In this scenario, DNA from an Original is collected without Original's knowledge and permission. The DNA is then used to complete a somatic nuclear transfer. This hypothetical would most likely arise when the person who is seeking to accomplish the cloning is either infatuated with Original (such as a fan who wishes to go one better than having Original's baby) or believes there to be some profit from cloning Original (such as an individual who cloned an elderly billionaire in the hope that the clone would inherit or take by intestate succession when the elderly billionaire died). Situations of unknowing cloning raise the same panoply of issues. First, what is the legal relationship, if any, between Original and Copy? Second, what are the "parental" rights and responsibilities, if any, of Original? Third, what are Copy's rights, if any, to seek child support, take by intestate succession, and the like. Other writers have suggested this general scenario. Consider the following statement:

Could cloning be criminally misused? If the technology to clone humans existed today, it would be almost impossible to prevent someone from cloning you without your knowledge or permission, says Philip Bereano, professor of technology and public policy at the University of Washington. Everyone gives off cells all the time—whenever we give a blood sample, for example, or visit the dentist—and those cells all contain one's full complement of DNA. What would be the goal of such 'drive-by' cloning? Well, what if a woman were obsessed with having the child of an apathetic man? Or think of the commercial value of a dynasty-building athletic pedigree or a heavenly singing voice. Even though experience almost certainly shapes these talents as much as genetic gifts, the unscrupulous would be unlikely to be deterred.

Herbert et al., *supra* note 7, at 61-62.

97. Other writers have suggested the possibility of multiple generations of clones. See, e.g., Goldman, *supra* note 6, at 115 (discussing the use of cloning as an alternative method of reproduction, the author states: "If there is a genetic basis for the infertility, then the cloned 'offspring' would likely be infertile as well. In a few generations, we would be seeing great-grand-clones.").

decides she wants to complete childbearing at one time. To achieve these goals, Original participates in the following cloning procedure:

Step #1: A somatic cell is taken from Original and, using one of Original's enucleated eggs, the doctor stimulates the development of Copy #1. Thus, Copy #1's genetic material is completely derived from Original.

Step #2: After the cells that will develop into Copy #1 have begun to divide but before they have begun to differentiate, the doctor removes one of the cells and stimulates it so that it begins to develop into Copy #2.⁹⁸ Copy #2 is an embryonic clone, that is, a clone created from an undifferentiated embryonic cell through embryo splitting. Because Copy #1's genetic material was completely derived from Original, Copy #2's genetic material also is completely identical to the genetic material possessed by Original.

Step #3: After the cells that will develop into Copy #2 have begun to divide but before they have begun to differentiate, the doctor removes one of the cells and stimulates it so that it begins to develop into Copy #3. Copy #3 also is an embryonic clone, that is, a clone created from an undifferentiated embryonic cell through embryo splitting. Copy #3's genetic material also is completely identical to the genetic material possessed by Copy #1 and Copy #2.

Step #4: The three groups of cells are implanted in Original's womb, where they develop normally.

How are Original and the three clones related? Are there Original and three identical clones/siblings, each of whom should be considered to be part of a single generation?⁹⁹ Proceeding backwards, is there a great-grandchild (Copy #3), a grandchild (Copy #2), a child (Copy #1), and a parent (Original)? If there is Original and three generations of clones, how are the generations to be measured for legal purposes such as inheritance? Should clone generations be measured by order of "conception/creation" or by order of birth? What would happen, for example, if the clones were born in reverse order of "conception/creation?"¹⁰⁰ It would be possible for Original's great-granddaughter (measured by time

98. I am going to offer no arguments regarding when "life" begins. I assume that those individuals who believe that "life" begins at conception would take the position that Copy #1 is a human being, although barely begun in its development. I assume that those individuals who believe that "life" begins at the time a fetus is viable would take the position that Copy #1 is not a human being until the point of viability. I am going to make the assumption that for determining the lineage of clones for legal purposes that clones created at the same time would either be considered siblings or they must be considered in generations.

99. Although one must look at the molecular level to find them, there undoubtedly are slight differences between the initial cells that produced the three clones.

100. The birth order of the clones might be difficult to determine if they all are implanted in, and carried to term by, Original. However, no such problem would present itself if the three different clones were kept separate and implanted into, and brought to term by, three different women.

of creation) to be born before Original's daughter (again, measured by time of creation).

To illustrate the problem: What would happen if Original died intestate on the first anniversary of the birth of the clones? Assuming that the clones were to be assigned designations used in existing intestate succession statutes, would all three clones be considered siblings, with Original's estate passing equally to all three clones? If this were not the outcome, which clone would be considered to be Original's daughter for the purpose of intestate succession? Would Copy #1 be considered to be Original's daughter because Copy #1 was the first clone to be conceived/created? Or would Copy #3 be considered to be Original's daughter because Copy #3 was the first clone to be born?

H. The Case of the Grandmother Who Never Had a Daughter

Assume the initial facts of the previous hypothetical. Doctors create three clones: Copy #1, Copy #2, and Copy #3. Prior to implanting the developing cells into Original's womb, Copy #1 and Copy #3 die *in petri*. Only Copy #2 is implanted into Original's womb,¹⁰¹ and Copy #2 grows to term and is born alive and well.

What is Original's relationship to Copy #2? Assuming Copy #2 is not treated as being Original for legal purposes, is Copy #2 Original's daughter? To all but the doctor who assisted Original, it would appear so. However, if the source of the genetic material which created Copy #2 is considered as being the dispositive factor, then Copy #2 is akin to Original's granddaughter. The oddity in this situation is that Original would have a granddaughter without ever having had a daughter born alive; and Copy #2 would have a grandmother without ever having had a mother born alive.

The objection may be raised that for legal purposes a clone should not be considered to be a person unless it is born alive or at least until it has reached the point of being viable. Consider, then, the situation in which all three copies are implanted in Original and grow to the point of viability. What would be the relationship between Original and Copy #2 should Copy #1 be still born? What would be the relationship between Original and Copy #2 if Copy #1 was born alive, but died immediately thereafter, and Copy #2 was subsequently born alive?¹⁰²

101. Because the deaths of Copy #1 and Copy #3 occurred *in petri*, the doctor could be certain that it was Copy #2 who resulted from the cells implanted in Original.

102. Many permutations of these facts could be proffered, but the hypothetical situations in the text raise the main point: Could there be situations in which an Original has a granddaughter without ever having had a daughter born alive? Could there be situations in which a clone could ever have a grandmother (or, in Copy #3's case, a great-grandmother) without ever having had a mother (or grandmother) born alive?

I. *The Case of Vehicular Confusion*

Assume that in the previous example Original had herself cloned only one time. Assume further that during the eighth month of her pregnancy (a time by which Copy was viable), Original was involved in an automobile accident caused entirely by a drunk driver. Unfortunately, the accident resulted in Original's death. Fortunately, Copy was delivered alive by caesarian section. With what crime should the drunk driver be charged? Would the drunk driver prevail in the argument that no charge of vehicular manslaughter should be filed because Copy really "is" Original due to the fact that Original and Copy share identical DNA?

J. *The Case of the Cloned Criminal*

Assume Original is convicted of first-degree murder and is sentenced to die. Original has herself cloned using one of her own enucleated eggs, and she carries Copy to term. Should Copy be considered to be the same entity as Original and be executed along with Original? If Copy dies prior to the time Original is scheduled to be executed should Original be deemed to have died, and should Original be released? Would the State have to accept Copy to be executed if Original were to offer Copy for execution in lieu of Original?

K. *The Case of the Cloned Cadaver*¹⁰³

Assuming deceased individuals can be cloned—either by immediate intervention or by recovering a sufficient amount of undecayed DNA—three scenarios seems possible. Should these scenarios be permitted? If they are permitted, what is the relationship of Copy to Original for intestate purposes, as a "child" in a will, and the like?

First hypothetical: Original, a man, dies in an accident. Susan, Original's distraught spouse, wants to have a child by Original even though he

103. Other writers have discussed this hypothetical. See, e.g., Ronald M. Green & A. Mathew Thomas, *DNA: Five Distinguishing Features for Policy Analysis*, 11 HARV. J.L. & TECH. 571, 580 (1998):

Although the scenarios here border on science fiction, it is no longer technically inconceivable to imagine someone's preserved somatic cell lines being used to reconstitute a genetic replicate of that individual. The possibility that one's genetic "twin" might be brought into being long after one's death dramatically illustrates the observation that DNA can be used at any time in the future, with or without one's consent, to reveal intimate, identifying facts about an individual.

Id.; Herbert et al., *supra* note 7, at 59:

Will it be possible to clone the dead? Perhaps, if the body is fresh, says Randall Prather, a cloning expert at the University of Missouri-Columbia. The cloning method used by Wilmut's lab requires fusing an egg cell with the cell containing the donor's DNA. And that means the donor cell must have an intact membrane around its DNA. The membrane starts to fall apart after death, as does DNA. But, yes, in theory at least it might be possible.

Id.; Howett, *supra* note 14, at 17 ("It's possible to analyze three individual hair follicles, you can recover enough DNA from this, tissue fragments from both intact or pieces of decayed corpses, or specimens that have embedded in paraffin in hospitals and kept for long periods of time.").

is deceased. Susan decides to have Original cloned rather than to conceive a child *in vitro* using one of her unfertilized eggs and sperm stored by Original in a sperm bank or sperm obtained from Original post mortem. At Susan's request, some of Original's somatic cells are taken from Original's body immediately after his death and are preserved. Later, Susan uses one of her enucleated eggs and undergoes a somatic nuclear transplant procedure using DNA preserved from Original.

Second hypothetical: Original, a woman, dies in an accident. Allen, Original's distraught spouse, wants to have a child by Original even though she is deceased. Original decides to have Original cloned instead of providing sperm to be mixed with an unfertilized egg which Original had stored at a fertility clinic. At Allen's request, some of Original's somatic cells are taken from Original's body immediately after her death and are preserved. Later, Allen has Original cloned using somatic nuclear transfer involving both Original's unfertilized egg and the DNA obtained from the somatic cells taken from Original after her death. Allen employs the use of a surrogate mother to carry Copy to term, at which time Copy is born healthy.

Third hypothetical: Original, a well-known rock star, dies. During an autopsy, somatic tissue is preserved in order to provide samples for further testing, should it be required. Susan, a devoted fan of Original, works at the hospital at which Original's tissue is being preserved. Susan obtains a small amount of the tissue and, using one of her unfertilized eggs, has a somatic nuclear transfer procedure performed using the DNA from Original. The resulting cells are implanted in Susan's uterus, she carried Copy to term, and Copy is born alive.

CONCLUSION

This Article has set forth a number of hypothetical situations to build a framework for policy makers and others in considering the practical legal issues that will be raised by the cloning of human beings. The hypothetical situations reveal that in addition to the legality of human cloning, four broad categories of issues exist. Rather than reacting to the cloning of human beings, policy makers, particularly legislators, should proactively consider each of the possible legal issues and provide a comprehensive statutory scheme to allow specific resolution of these issues.