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Reproductive Cloning: Another Look

Bonnie Steinbock
Bonnie.Steinbock@chicagounbound.edu

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Bonnie Steinbock[†]

Somatic cell nuclear transfer ("SCNT") in mammals involves removing the nucleus, which contains the DNA, from a somatic cell (any cell in the body other than a gamete, that is, sperm or oocyte (egg)), and putting it into an enucleated oocyte (that is, an oocyte from which the nucleus has been removed).[1] Fusion of the donor somatic cell's nucleus and the recipient enucleated oocyte can be performed chemically or, more often, by a jolt of electricity (a process called electroporation).[2] If the process is successful, the newly created cell will start to divide and become an embryo.[3] SCNT for reproductive purposes is also known as human reproductive cloning.[4]

In 1997, the Report of the National Bioethics Advisory Commission ("Report") entitled *Cloning Human Beings*[5] recommended "[a] continuation of the current moratorium on the use of federal funding in support of" research into SCNT cloning for reproductive purposes.[6] The National Bioethics Advisory Commission's ("NBAC") objection to human reproductive cloning was based primarily on safety grounds,[7] such as the high probability

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[†] Professor of Philosophy, The University at Albany/State University of New York. Thanks to the late Lorraine Flaherty, Lee Silver, Ann Willey, and most especially Sean Philpott for helping me to understand the science of cloning. I am grateful to the staff of the University of Chicago Legal Forum for their invaluable work during the editing of this Article.

[1] See National Academy of Sciences Panel ("NAS Panel"), *Scientific and Medical Aspects of Human Reproductive Cloning* 6 (Natl Academy 2002) ("[T]he nucleus of an egg cell (containing its chromosomes) is removed and replaced with the nucleus of a cell taken from the body of an adult (a 'somatic cell').").

[2] See Kerry Lynn Macintosh, *Illegal Beings: Human Clones and the Law* 51 (Cambridge 2005) (describing the process of cloning, including chemical or electrical fusion).

[3] See NAS Panel, *Human Reproductive Cloning* at 25 (cited in note 1) (describing the process of cloning).

[4] Id at 6 (describing human reproductive cloning as SCNT "carried out with the goal of creating a human being").

[5] National Bioethics Advisory Commission ("NBAC"), *Cloning Human Beings* (1997).

[6] Id at 109.

[7] See id at 108 ("The Commission reached a consensus on this point because current scientific information indicates that this technique is not safe to use in humans at this time.").

of failure and consequent high risk of miscarriage, and the risk of developmental abnormalities in offspring.[8] Critics of the Report alleged that in focusing primarily on safety issues, NBAC "duck[ed] the moral questions."[9] They had hoped that NBAC would give an unqualified rejection of human reproductive cloning based on moral concerns such as human individuality and dignity, the commodification of children, and the opportunity for genetic enhancement.[10]

However, NBAC did not *duck* the moral issues; it simply was unable to reach a consensus on them. Given the diverse ethical and political views of the members of NBAC, it is not surprising that safety was the only factor on which all members could agree, especially within the ninety day time constraint President Clinton imposed.[11] The Report recommended that the moral debate continue, so that when the five year moratorium ended, the moral issues would be better defined.[12]

Eight years later, are we any clearer on the morality of human reproductive cloning (or as the President's Council on Bioethics ("President's Council") prefers to call it, "cloning-to-produce-children"[13])? There is widespread, indeed nearly universal, agreement that human reproductive cloning should not proceed.[14] In part, the vehement rejection of reproductive cloning can be seen as a political calculation on the part of supporters of therapeutic cloning that unless they completely dissociate themselves from reproductive cloning, they will be unable to garner

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[8] See id at 64 ("It is important to recognize that the technique that produced Dolly the sheep was successful in only 1 of 277 attempts. If attempted in humans, it would pose the risk of hormonal manipulation in the egg donor; multiple miscarriages in the birth mother; and possibly severe developmental abnormalities in any resulting child.").

[9] Gina Kolata, *Commission on Cloning: Ready-Made Controversy*, NY Times A12 (June 9, 1997) (attributing the criticism to George Annas, a law professor at Boston University).

[10] These claims have been made by, among others, George J. Annas in *At Issue; Human Cloning*, 83 ABA J 80 (May 1997).

[11] See letter from William J. Clinton, President of the United States, to Harold Shapiro, Chair, National Bioethics Advisory Commission (Feb 24, 1997) reprinted in NBAC, *Cloning Human Beings* (cited in note 5) ("[R]eport back to me within ninety days with recommendations.").

[12] NBAC, *Cloning Human Beings* at 108 (cited in note 5) ("[M]any other serious ethical concerns have been identified, which require much more widespread and careful public deliberation before this technology may be used.").

[13] President's Council on Bioethics ("President's Council"), *Human Cloning and Human Dignity: An Ethical Inquiry* 44 (2002).

[14] See id at 28 ("A widespread—though not universal—consensus emerged that attempts to clone a human being would at present be irresponsible and immoral.").

support for what they regard as much more important: therapeutic cloning.[15]

Therapeutic cloning refers to the use of SCNT cloning to create embryos from which embryonic stem cells are removed and stem cell lines created.[16] The hope is that these embryonic stem cell lines could one day be used to cure a range of diseases and injuries, including diabetes, cancer, heart disease, Parkinson's, and spinal cord injuries.[17] In both therapeutic and reproductive cloning, the same technique is used to create an embryo, but in reproductive cloning the embryo is gestated to become a fetus, and then a baby.[18] In therapeutic cloning, the embryo is created as a source of embryonic stem cells. However, since removing the stem cells destroys the embryo, this research is unacceptable to those who regard human embryos as having the same moral status as born human beings.[19]

Some believe the term "therapeutic cloning" is misleading. The President's Council noted that,

> [t]he act of cloning embryos may be undertaken with healing motives. But it is not *itself* an act of healing or therapy. The beneficiaries of any such acts of cloning are, at the moment, hypothetical and in the future. And if medical treatments do eventually result, the embryonic clone from which the treatment was derived will not itself be the beneficiary of any therapy. On the contrary, this sort

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[15] See, for example, Rudolph Jaenisch and Ian Wilmut, *Don't Clone Humans!*, 291 Science 2552, 2552 (Mar 30, 2001) (arguing that association with the pro-reproductive cloning activists could reduce support for therapeutic cloning).

[16] See John A. Robertson, *Two Models of Human Cloning*, 27 Hofstra L Rev 609, 611-12 (1999) (describing therapeutic cloning and the creation of embryonic stem cell lines).

[17] See id at 612 ("[I]f human [embryonic stem] cells could be directed to differentiate into particular tissues and immunologically altered to prevent rejection after engraftment, they could treat or cure thousands of patients who now suffer from diabetes, neurodegenerative disorders, spinal cord injury, heart disease, and other illnesses."); President's Council, *Human Cloning* at 131-32 (cited in note 13) (describing the possibility that cloning could lead to a treatment for Parkinson's disease).

[18] See NAS Panel, *Human Reproductive Cloning* at 6 (cited in note 1) (noting that in both reproductive and therapeutic cloning, "researchers would use nuclear transplantation").

[19] See, for example, President's Council, *Human Cloning* at 153 (cited in note 13):

> Some of us who oppose cloning-for-biomedical-research hold that efforts to assign to the embryo a merely intermediate and developing moral status—that is, more humanly significant than other human cells, but less deserving of respect and protection than a human fetus or infant—are both biologically and morally unsustainable, and that the embryo is in fact fully 'one of us.'

Id.

of cloning actually takes apart (or destroys) the embryonic being that results from the act of cloning.[20]

To avoid any misleading implications, the President's Council recommended the term "research cloning" or "cloning-for-biomedical-research."[21]

Many supporters of therapeutic cloning think that politically it would be wise to dissociate themselves from reproductive cloning.[22] As Rudolph Jaenisch and Ian Wilmut put it, "[p]ublic reaction to human cloning failures could hinder research in embryonic stem cells for the repair of organs and tissues. . . . The potential benefit of this therapeutic cell cloning will be enormous, and this research should not be associated with the human cloning activists."[23] This could be a smart move. Should the promise of therapeutic cloning be realized, an extremely large number of people would benefit—many more than the number of people interested in reproductive cloning. But politics aside, are there well-founded moral arguments against human reproductive cloning?

I. SAFETY ARGUMENTS

Arguments about the safety of certain research techniques or new technologies are clearly relevant to the morality of engaging in that research or using the new technology. Every code of ethics concerning research on human subjects emphasizes the importance of protecting subjects from undue risks of harm.[24]

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[20] Id at 44.

[21] Id at 45.

[22] See, for example, Jaenisch and Wilmut, 291 Science at 2552 (cited in note 15) ("The potential benefit of this therapeutic cell cloning will be enormous, and this research should not be associated with the human cloning activists."). But see Gary Rosen, *What Would A Clone Say?*, NY Times Sunday Magazine 19 (Nov 27, 2005) (arguing that reproductive cloning, which would result in a human being, is less troubling than therapeutic cloning, which creates nascent human life with the declared aim of destroying it for medical experimentation).

[23] Jaenisch and Wilmut, 291 Science at 2552 (cited in note 15).

[24] See, for example, *Trials of War Criminals before the Nuremberg Military Tribunals: Case One:* U.S. v. Karl Brandt, et al., (Washington, DC 1949) (charging defendants with and convicting most of, among other things, crimes against humanity for "medical experiments without the subjects' consent" and declaring that experiments on human subjects "should be so conducted as to avoid all unnecessary physical and mental suffering and injury"); The Nuremberg Code of Ethics in Medical Research (1947), reprinted in George J. Annas and Michael A. Grodin, eds, *The Nazi Doctors and The Nuremburg Code: Human Rights in Human Experimentation* 2 (Oxford 1992) (setting out ten requirements for experimentation with human subjects, including avoiding undue harm); World Medical Association, *Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects* (Edinburgh 2000) ("[C]onsiderations related to the

While it may be controversial whether the information likely to be obtained from a particular research protocol justifies the risk of harm to human subjects, there is no doubt that the imposition of risk always requires justification—the potential for harm is always an ethical reason against performing an experiment or using a certain technology.[25]

Another advantage of focusing on the safety of a technique like cloning is that safety arguments are, or are usually thought to be, less subjective than other kinds of moral arguments because they are based on empirical evidence, as opposed to moral principles and values. Yet precisely because they are based on the current state of the science, safety arguments can only express contingent opposition to cloning: if cloning techniques become safe and effective, the safety argument evaporates. Because many opponents of reproductive cloning favor a flat ban on reproductive cloning, not a temporary or limited one, they are not satisfied with arguments from safety.[26] Moreover, although safety claims are supposed to be scientific and empirical, critics have charged that they are often motivated by a moral aversion to cloning rather than by an objective assessment of the science involved.[27]

A. Is Human Reproductive Cloning Even Possible?

Since as yet no one has ever cloned and brought to full term a human being,[28] we have no direct evidence about whether it

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well-being of the human subject should take precedence over the interests of science and society."); Department of Health, Education, and Welfare ("DHEW"), The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, *The Belmont Report: Ethical Principles and Guidelines for the Protection of Human Subjects of Research* (1978) (describing the principles of respect for person, beneficence, and justice that should guide research with human subjects); Department of Health and Human Services, Protection of Human Subjects, 45 CFR § 46 (2005) (outlining federal regulation concerning protection of human subjects).

[25] See, for example, DHEW, *The Belmont Report* (cited in note 24) (describing three principles for research with human subjects and declaring that the benefit of research must always be weighed against the risks).

[26] President's Council, *Human Cloning* at xxviii-xxix (cited in note 13) (identifying the following concerns regarding reproductive cloning: problems of individuality and identity among cloned children; concerns regarding society's attitude toward children who are the product of a manufacturing process; the prospect of a new eugenics; troubled family relations; broader effects on society).

[27] See Macintosh, *Illegal Beings* at 44 (cited in note 2) (arguing that "safety concerns are [not] the primary force motivating public and political opposition to cloning and human clones" because otherwise opponents would not revert to moral arguments).

[28] In 2001, some individuals and organizations declared their intentions to carry out reproductive cloning of humans in the near future: Professor Severino Antinori of the International Associated Research Institute, Italy; Professor Panos Zavos of the Androl-

can be done safely. In fact, there is some doubt about whether it is even possible to clone a human being.[29] In 2004, a South Korean team, headed by Dr. Hwang Woo Suk, claimed to have cloned a human blastocyst.[30] In June 2005, his team claimed to have cloned human blastocysts using DNA from eleven patients, through an efficient new technique that required very few human eggs.[31] However, it was later determined that Dr. Hwang had fabricated the evidence supporting his claims.[32] While the Hwang debacle was undoubtedly something of a setback for therapeutic cloning,[33] British scientists have since managed to clone human blastocysts for research purposes,[34] demonstrating

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ogy Institute of America, and Dr. Brigitte Boisselier, director of Clonaid. NAS Panel, *Human Reproductive Cloning* at 74, 89 nn 1-3 (cited in note 1). Clonaid announced the birth of its first clone on December 26, 2002, see *Clonaid Claims Birth of First 5 Cloned Babies*, globalchange.com, available at <www.globalchange.com/clonaid.htm> (last visited Apr 19, 2006), and as of December 3, 2005, claimed the birth of thirteen human clones. *Alive and Well*, Clonaid.com, (Mar 27, 2004), available at <http://www.clonaid.com/news.php?4> (last visited Apr 19, 2006). These claims have not been substantiated, and there is suspicion that the story is part of an elaborate hoax to bring publicity to the Raëlian movement. See Kenneth Chang, *Saying That Hoax Is Possible, Journalist Leaves Cloning Tests*, NY Times A12 (Jan 7, 2003) (describing the possibility of a hoax to bring publicity to the Raëlian movement). Neither Professor Antinori nor Professor Zavos have claimed to succeed in cloning a human baby. Indeed, it is not clear that they are still trying to do so. A search for "reproductive cloning" on the web site of the Andrology Institute of America turned up no matches. <http://www.aia-zavos.com/drz.htm> (last visited Apr 19, 2006).

[29] See, for example, Randall R. Sakai, et al, *Cloning and Assisted Reproductive Techniques: Influence on Early Development and Adult Phenotype*, 75 Birth Defects Research (Part C) 151, 152 (2005) ("[T]here is no evidence that [human cloning] has indeed occurred, or is even possible."). But see Keith E. Latham, *Cloning: Questions Answered and Unsolved*, 72 Differentiation 11, 17 (Feb 2004) ("There is little reason to believe that the answer to [the question whether humans can be cloned] is negative.").

[30] Nicholas Wade and Choe Sang-Hun, *Human Cloning Was All Faked, Koreans Report*, NY Times A1 (Jan 10, 2006). See also NAS Panel, *Human Reproductive Cloning* at 260 (cited in note 1) (defining a blastocyst as "[a] preimplantation embryo in placental mammals . . . of about 30-150 cells").

[31] Wade and Sang-Hun, *Human Cloning Was All Faked*, NY Times at A1 (cited in note 30).

[32] Id.

[33] But see Evan Y. Snyder and Jeanne F. Loring, *Beyond Fraud—Stem-Cell Research Continues*, 354:4 New Eng J Med 321, 321 (Jan 26, 2006) ("Although the events of Hwang's story provide a case study of some of the worst aspects of high-profile, high-stakes global science, they also include some reassuring elements.").

[34] In August 2004, scientists at the University of Newcastle were given permission by the Human Fertilisation and Embryology Authority to attempt therapeutic cloning. BBC News, *Dolly Scientists' Human Clone Bid*, (Sept 28, 2004), available at <http://news.bbc.co.uk/2/hi/health/3695186.stm> (last visited Apr 19, 2006). In 2005, they reported that they successfully cloned the country's first human embryo. BBC News, *UK Scientists Clone Human Embryo*, (May 20, 2005), available at <http://news.bbc.co.uk/1/hi/health/4563607.stm> (last visited Apr 19, 2006). Ian Wilmut has also received permission to clone embryos in the hope of finding new treatments for motor neuron disease. BBC News, *Should Embryo Cloning be Licensed?*, (Feb 10, 2005), available at

that it is indeed possible. However, neither British laboratory intends to transfer the cloned embryos to a uterus for gestation.[35]

Reproductive cloning has also been attempted with nonhuman primates. In 2004, Dr. Gerald Schatten and his team from the University of Pittsburgh reported that they had cloned 135 monkey embryos using Dr. Hwang's technique, and transferred them into 25 mothers.[36] However, none of them resulted in a pregnancy that lasted more than a month.[37] Nor has anyone else succeeded in bringing a cloned primate to term. So far, there has been only one report of a birth of a cloned rhesus monkey, and that report has not been replicated.[38] Dr. Schatten says that his research cannot be used as evidence that a cloned human baby could survive long in development.[39]

B. Would Human Reproductive Cloning be Safe?

At this point, it seems we must remain agnostic about whether human reproductive cloning is possible. The next question is whether it would be safe. To answer that question, we must look to the experience with cloning other animals, including mice, sheep, goats, pigs, cattle, cats, and, most recently, a dog.[40]

<http://news.bbc.co.uk/1/hi/talking_point/ 4246431.stm> (last visited Apr 19, 2006).

[35] See BBC News, *Dolly Scientists' Human Clone Bid*, (cited in note 34) (describing both teams' goals as "therapeutic cloning").

[36] Helen Pearson, *Biologists Come Close to Cloning Primates*, news@nature.com (Oct 21, 2004), available at <http://www.nature.com/ news/2004/041018/pf/041018-12_pf.html> (last visited Apr 19, 2006). In light of the discovery that Dr. Hwang did not succeed in cloning any human embryos, it might be questioned how and even whether Dr. Schatten was able to use Dr. Hwang's technique to clone monkey embryos. Though an investigative panel at the University of Pittsburgh exonerated Dr. Schatten from allegations of scientific misconduct in his past collaborations with Dr. Hwang, Korean prosecutors continue to investigate whether Dr. Schatten and Dr. Hwang collaborated in the fabrication of research data. Kim Rahn, *Prosecutors Summon Hwang, Key Collaborators*, Korea Times (Mar 3, 2006); Kim Tong-Hyung, *Scientist Schatten Key to Stem Cell Scandal*, Korea Times (Feb 19, 2006).

[37] Pearson, *Cloning Primates* (cited in note 36).

[38] See Calvin Simerly, et al, *Molecular Correlates of Primate Nuclear Transfer Failures*, 300 Science 297, 297 (Apr 11, 2003) (describing the birth of a rhesus monkey after embryonic cell nuclear transfer).

[39] Pearson, *Cloning Primates* (cited in note 36).

[40] See Jose B. Cibelli, et al, *The Health Profile of Cloned Animals*, 20 Nature Biotechnology 13, 14 (Jan 2002) (describing the health profiles of cloned mice, sheep, goats, pigs, and cattle); *Cat Cloning*, Genetic Savings and Clone, available at <http://www.savingsandclone.com/services/cat_cloning.html> (last visited Apr 19, 2006) (selling cloned cats). The Seoul National University panel that determined that Dr. Hwang had not cloned any human embryos confirmed that he had indeed cloned the dog he named Snuppy. Wade and Sang-Hun, *Human Cloning Was All Faked*, NY Times at A1 (cited in note 30).

Such evidence is not perfect, since every species is different, but it is the best we have.

In *Remaking Eden*,[41] Lee Silver suggested that cloning might be *safer* than ordinary sexual reproduction, since many genetic diseases are the result of autosomal recessive genes which are transmitted to offspring only when both parents carry the recessive trait.[42] For example, if two carriers of a gene for cystic fibrosis ("CF") mate, there is a 25 percent chance that the resulting child will have CF, a 25 percent chance the child will be disease-free, and a 50 percent chance the child will be a carrier.[43] But if a carrier for CF, or any autosomal recessive trait, were cloned, he or she would not transmit the disease.[44] For this reason, Silver argued that the rate of genetic defects in cloned animals would be inherently lower than in animals created through sexual reproduction.[45]

However, when *Remaking Eden* was written, only one animal, a sheep called Dolly,[46] had ever been cloned, and Silver did not anticipate the health problems that subsequently came to light. Dolly, Silver says, "was perfectly normal no matter what rumors you've heard."[47] Since Dolly, many healthy clones have been born and have survived to fertile adulthood.[48]

Cloned cattle often suffer from "large offspring syndrome" ("LOS"), as well as "more drastic defects," such as placental mal-

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[41] Lee Silver, *Remaking Eden: How Genetic Engineering and Cloning Will Transform the American Family* (Avon 1997).

[42] Id at 121 ("With cloning, any silent mutation in the donor will remain silent within the newly formed embryo and child as well. . . . [B]irth defects in cloned children could occur less frequently than birth defects in naturally conceived children.").

[43] Consider id (noting that some "genetic abnormalities result from the inheritance of two mutant copies of a gene that were each carried silently within the two parents").

[44] Id.

[45] See Silver, *Remaking Eden* at 121 (cited in note 41) ("[B]irth defects in cloned children could occur less frequently than birth defects in naturally conceived children.").

[46] For a general discussion, see Michael Specter and Gina Kolata, *A New Creation: The Path to Cloning-A Special Report: After Decades of Missteps, How Cloning Succeeded*, NY Times A1 (Mar 3, 1997) (describing the cloning of Dolly the sheep).

[47] E-mail from Lee Silver to Bonnie Steinbock (Oct 7, 2005) (on file with author). Actually, Dolly did suffer from arthritis, but Wilmut thinks that it is unlikely that it was a result of her having been cloned. Instead, he thinks it may have been caused by her standing on her back legs to greet visitors. Rick Weiss, *Middle-Aged Dolly Develops Arthritis: Questions on Clones' Aging Raised*, Wash Post A03 (Jan 5, 2002). She also developed a contagious lung disease that was spreading among the sheep at the Roslin Institute, which led to her being euthanized in 2003 at the age of 6 years. Again, the cause was probably not having been cloned, since sheep that live indoors–as was necessary in the case of Dolly for security reasons–are prone to developing lung infections of this kind. Macintosh, *Illegal Beings* at 63 (cited in note 2).

[48] NAS Panel, *Human Reproductive Cloning* at 40 (cited in note 1).

function, respiratory distress, and circulatory problems, the most common causes of neonatal death.[49] "Even apparently healthy survivors may suffer from immune dysfunction, or kidney or brain malformation, which can contribute to death later. So, if human cloning is attempted, those embryos that do not die early may live to become abnormal children and adults; both are troubling outcomes."[50] Often cited as safety reasons not to pursue human reproductive cloning are its inefficiency and the consequent risk of miscarriage and stillbirth, premature aging, and LOS. I will consider each of these in turn.

1. Inefficiency.

Only a few percent of nuclear transfer embryos survive to birth, and of those, many die within the perinatal period.[51] According to Jaenisch and Wilmut, "[t]here is no reason to believe that the outcomes of attempted human cloning will be any different."[52] In her recent book, *Illegal Beings*,[53] law professor Kerry Lynn Macintosh argues that the inefficiency argument is a half truth.[54] In particular, she objects to the way the media presented Dolly's story.[55] It took Wilmut and his associates 277 attempts to get Dolly,[56] but the story was often presented as if there were 277 miscarriages. For example, a congressional report recommending a complete ban on human reproductive cloning claimed that "[c]loning experiments produced 277 stillborn, miscarried or dead sheep before Dolly was successfully cloned. That failure rate, which has remained steady since 1997, is not acceptable for human beings."[57] However, 277 actually refers to the number of

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[49] Jaenisch and Wilmut, 291 Science at 2552 (cited in note 15).

[50] Id. See also Nadia Halim, *Scientists Show Cloning Leads to Severe Dysregulation of Many Genes*, Whitehead Institute for Biomedical Research (Sept 11, 2002), available at <http://www.wi.mit.edu/ news/archives/2002/rj_0911.html> (last visited Apr 19, 2006) ("[E]ven seemingly 'normal-looking' clones may have serious underlying epigenetic abnormalities."); John Travis, *Dolly Was Lucky*, Science News Online, available at <http://www.geneimprint.com/articles/?y=Press&q=cloning/sciencenews/index.html> (last visited Apr 19, 2006) (describing a cloned sheep that had to be euthanized due to a severe respiratory problem, quoting Ian Wilmut, "Who would want to be responsible for a child born with an abnormality like that?").

[51] Jaenisch and Wilmut, 291 Science at 2552 (cited in note 15).

[52] Id.

[53] Macintosh, *Illegal Beings* (cited in note 2).

[54] Id at 48.

[55] See id ("[R]eporters and lawmakers often misstate the facts of this adult-cell experiment.").

[56] Id.

[57] Human Cloning Prohibition Act, HR Rep No 107-170, 107th Cong, 1st Sess 4

enucleated eggs Wilmut used. "In fact, there were no miscarriages, no deformed lambs, and no deaths resulting from the transfer of the *adult* cell nuclei in the Dolly experiment."[58] Macintosh acknowledges that some of Wilmut's other experiments did end in miscarriages, but in those experiments he tried to clone sheep from embryonic and fetal cells.[59] Macintosh maintains that it is not surprising that these attempts had a high failure rate.[60] The majority of embryos and fetuses produced by sexual reproduction never make it to birth,[61] so why should we expect a different result with cloning? By contrast, when a somatic cell from an adult animal is used, you are using DNA that has proven its ability to generate a healthy term birth.

Nevertheless, even if Dolly's case was misreported, a relatively high rate of miscarriage, stillbirth, and neonatal mortality has plagued animal cloning. As the National Academy of Sciences Panel put it, "across multiple species there are far more failures in the development of cloned fetuses than there are live normal births."[62] In animals, the low efficiency rate of cloning makes it an economically unfeasible reproductive technique. In human beings, a reproductive technique that resulted in a high rate of miscarriage would be ethically unacceptable, especially since the losses do not occur only in very early pregnancy, as is common in natural pregnancies.[63] "Whereas most fetal losses in conventional zygotic pregnancies occur in the first trimester, with reproductive cloning, fetuses are lost throughout pregnancy and in the early neonatal period."[64] This is of great concern, not only because a late miscarriage is more likely to be emotionally more distressing to the mother than an early one, but also be-

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(2001).

[58] Macintosh, *Illegal Beings* at 48 (cited in note 2).

[59] Id at 49.

[60] See id ("[W]hen cloning from nuclear DNA harvested from embryos and fetuses, one might expect a fairly significant number of failures to occur simply because the selected genomes are inadequate.").

[61] See id ("[I]n human reproduction, up to 75 percent of embryos conceived through sexual intercourse never make it to birth.").

[62] NAS Panel, *Human Reproductive Cloning* at 40 (cited in note 1).

[63] Consider Philip G. Peters, Jr., *How Safe Is Safe Enough? Obligations to the Children of Reproductive Technology* 228 (Oxford 2004) (arguing that if prospective parents have been fully informed about the risk of early miscarriage, they should be able to make the decision whether to tolerate this risk, "at least if the fetal loss is likely to occur in vitro or early in the pregnancy" and noting that because there is wide disagreement in our society about the moral status of embryos, "lawmakers should resist the temptation to take the decision . . . away from prospective parents").

[64] NAS Panel, *Human Reproductive Cloning* at 40 (cited in note 1).

cause of the increased risk of maternal morbidity and mortality.[65] Cloning studies in animals show that there are often abnormalities in the placenta or the fetus, which probably cause the miscarriage.[66] These pregnancy complications, along with pregnancy toxemia, also pose a risk to maternal health.[67] What about the health of cloned animals that do manage to survive? According to some reports, the majority are "physiologically and reproductively normal."[68] However, some health problems have been flagged.

2. Premature aging.

It has been charged that nuclear transfer results in an animal with shortened telomeres.[69] Telomeres are the caps on the ends of chromosomes, and they shorten as somatic cells age.[70] Thus, there is a potential for cloned embryos, whose chromosomes come from somatic cells, to have shortened telomeres, producing an animal that is older than her chronological age.[71] While this claim was made about Dolly, it is not clear that Dolly really had shortened telomeres, or that she suffered from premature aging.[72] One reason to doubt that her telomeres were too short is that telomeres are very small, making it difficult to measure them accurately.[73] The alleged difference between Dolly and other sheep of her age "could be within the range of natural variation in the telomere lengths of sheep."[74] In addition, such

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[65] Id.

[66] Id.

[67] Id.

[68] K.H.S. Campbell, et al, *Cloning: Eight Years After Dolly*, 40 Reproduction in Domestic Animals 256, 257 (2005). But see Halim, *Scientists Show Cloning Leads to Severe Dysregulation of Many Genes* (cited in note 50) (reporting on a study that "confirmed that the cloning process jeopardizes the integrity of an animal's whole genome").

[69] See, for example, Gina Kolata, *Cloned Sheep Showing Signs of Old Cells, Report Says*, NY Times A19 (May 27, 1999) (reporting the possibility that Dolly had shortened telomeres); Macintosh, *Illegal Beings* at 61 (cited in note 2) (describing the argument about shortened telomeres).

[70] NAS Panel, *Human Reproductive Cloning* at 48 (cited in note 1).

[71] Id.

[72] See Kolata, *Cloned Sheep Showing Signs of Old Cells*, NY Times at A19 (cited in note 69) (describing Dolly's shortened telomeres, acknowledging how difficult telomeres are to measure); Weiss, *Middle-Aged Dolly Develops Arthritis*, Wash Post at A03 (cited in note 47) ("Subsequent research has suggested that Dolly's chromosomes may not in fact be abnormally truncated.").

[73] See Kolata, *Cloned Sheep Showing Signs of Old Cells*, NY Times at A19 (cited in note 69) ("You have to appreciate that the measurement of telomere length is not an exact science.").

[74] Macintosh, *Illegal Beings* at 61 (cited in note 2) ("The scientists admitted that this

shortening has not been found in clones of other species, such as cattle.[75] The report of the National Academies of Sciences Panel noted that the possibility of prematurely old clones "does not seem to be a major concern. Any shortening of telomeres in cloned sheep appears to be minor and can be minimized by judicious choice of the cell type used as a nucleus donor."[76] Moreover, human blastocysts have high levels of telomerase activity, which suggests that they might be able to rebuild telomeres after reproductive cloning.[77]

3. Large Offspring Syndrome.

Of greater concern than premature aging is the tendency of cloned cattle fetuses and newborns to grow to abnormally large sizes, jeopardizing their own health and that of the mothers who gestate and give birth to them.[78] This defect is referred to as "large offspring syndrome" ("LOS").[79] In addition to LOS, abnormal placentas, maternal and fetal distress, and cardiovascular abnormalities have been observed.[80] However, it is not clear that LOS would occur in cloned humans. Cows and sheep conceived through in vitro fertilization ("IVF") also have a tendency toward LOS, and this has not been observed in human babies.[81] In fact, human babies conceived through IVF tend to be smaller than normal.[82] Moreover, a team of scientists, led by Randy Jirtle, at Duke University claim to have discovered that a key gene restraining embryo growth, called insulin-like growth factor 2 receptor ("IGR2R"), cannot be switched off during human cloning.[83] This, they allege, would make LOS in humans far less likely, and thus make human cloning safer than animal cloning.[84] But other

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difference could be within the range of natural variation in the telomere lengths of sheep.").

[75] Id at 62 (noting that cloned cattle "had telomeres that were significantly longer than those of regular cows of the same age").

[76] NAS Panel, *Human Reproductive Cloning* at 48 (cited in note 1).

[77] Id.

[78] Id at 41-42.

[79] Id at 41.

[80] NAS Panel, *Human Reproductive Cloning* at 41 (cited in note 1).

[81] Id.

[82] Consider Peters, *How Safe is Safe Enough?* at 47 (cited in note 63) (noting that "in vitro fertilization carries roughly twice the risk of . . . low weight in term singleton babies").

[83] Andy Coghlan, *Human Cloning 'Safer' than Animal Cloning*, New Scientist (Aug 15, 2001), available at <http://www.newscientist.com/article/dn1155.html> (last visited Apr 19, 2006).

[84] Id.

cloning experts call Jirtle's claim "ludicrous," noting that disruption of other imprinted genes might be just as important as the disruption of IGF2R.[85]

At this point, no one really knows what causes LOS or why it occurs in some species and not others. "All that can be said is that it probably results from abnormal gene expression in the early embryo, including the misexpression of imprinted genes."[86] Thus, to understand LOS and other abnormalities in cloned animals, we need to understand a little bit about embryonic development in sexual reproduction and cloning.

4. Genetic imprinting and reprogramming.

In ordinary sexual reproduction, offspring receive two copies of each gene, one from the mother, the other from the father.[87] In some cases, for normal development to occur, one of those copies must be silenced or switched off, so that only one copy of the gene is expressed.[88] This silencing or switching off is known as genetic imprinting.[89] Many people believe that the low efficiency of cloning, as well as the abnormalities observed in cloned animals, are due to imprinting failures that occur during the cloning process.[90] These anomalies are epigenetic, that is, they concern the expression of genes.[91]

After fertilization occurs, the fertilized egg, or zygote, begins to divide into many cells.[92] Each of these cells is undifferentiated in that it can give rise to any of the cells in the body.[93] Eventually, the cells become differentiated: distinct cell types.[94] By contrast, the nucleus of a cloned embryo comes from a differentiated cell, a somatic cell of a specific type. If it retains its particular pattern of gene expression, it cannot develop into all the different

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[85] Id.

[86] NAS Panel, *Human Reproductive Cloning* at 41 (cited in note 1).

[87] President's Council, *Human Cloning* at 58 (cited in note 13).

[88] Macintosh, *Illegal Beings* at 52 (cited in note 2).

[89] Id ("[A] gene is said to be imprinted if it is repressed, that is, 'switched off' and not functioning.").

[90] For a general discussion of the argument that many problems related to cloning arise during reprogramming, see id at 54-61.

[91] See NAS Panel, *Human Reproductive Cloning* at 263 (cited in note 1) (defining epigenetic effects as "[c]hanges in gene expression that occur without changing the DNA sequence of a gene").

[92] President's Council, *Human Cloning* at 58 (cited in note 13).

[93] See NAS Panel, *Human Reproductive Cloning* at 271 (cited in note 1) (defining undifferentiated as "[n]ot having developed into a specialized cell or tissue type").

[94] See id at 262 (defining differentiated as "[h]aving developed into a specialized cell or tissue type").

cells of the body. The trick in SCNT cloning is to undo the cell-specific pattern of the donor somatic cell in a process known variously as genetic, nuclear, or genomic reprogramming.[95]

Jaenisch and Wilmut argue that, in general, the defects in fetal clones and live-born cloned offspring are due to failures in genomic reprogramming.[96] It is possible that successful genomic reprogramming requires that the cytoplasm receive two distinct sets of DNA—one from a sperm and one from an egg—as in ordinary sexual reproduction.[97] Thus epigenetic errors in cloning may result from the fact that the egg cytoplasm, which does the reprogramming, is presented with two sets of DNA from a single somatic cell.[98]

Alternatively, the epigenetic errors may have to do with the timing of reprogramming. Epigenetic reprogramming normally is accomplished during spermatogenesis and oogenesis, "processes that in humans take months and years, respectively."[99] By contrast, in nuclear transfer, the reprogramming of the cloned embryos must occur "within minutes or, at most, hours."[100] This time difference could cause reprogramming errors, which "could lead in turn to dysregulation of gene expression."[101]

However, some have argued that the problem is not that the reprogramming occurs too quickly in nuclear transfer, but that it

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[95] See id at 263 (defining reprogramming as "resetting the developmental state of an adult differentiated cell nucleus so that it can carry out the genetic program of an early embryonic cell nucleus"). See also Dominic J. Ambrosi and Theodore P. Rasmussen, *Reprogramming Mediated by Stem Cell Fusion*, 9 J Cellular & Molecular Medicine 320, 320 (2005) ("Nuclear reprogramming is the functional conversion of the genetic material contained within a differentiated somatic cell to a state of developmental pluripotency or multipotency.").

[96] See Jaenisch and Wilmut, 291 Science at 2552 (cited in note 15):

> Normal development depends upon a precise sequence of changes in the configuration of the chromatin and in the methylation state of the genomic DNA. These epigenetic alternations control tissue-specific expression of genes. For cloning technology, the crucial question is a simple one: Is the configuration of chromatin changes acquired by a donor nucleus in the injected oocyte functionally identical to that resulting from gametogenesis and fertilization?

Id. See also Ambrosi and Rasmussen, 9 J Cellular & Molecular Medicine at 321 (cited in note 95) ("a major component of the inefficiency likely involves less-than-perfect nuclear reprogramming"). Consider H. Niemann, et al, *Gene Expression Patterns in Bovine In vitro-Produced and Nuclear Transfer-Derived Embryos and Their Implications for Early Development*, 4 Cloning & Stem Cells 29, 36 (Mar 2002) (asserting that "random errors in global methylation pattern contribute to the incidence of developmental anomalies in cloned offspring").

[97] NAS Panel, *Human Reproductive Cloning* at 46 (cited in note 1).

[98] Id.

[99] Jaenisch and Wilmut, 291 Science at 2552 (cited in note 15).

[100] Id.

[101] Id.

occurs too slowly. According to one author, nuclear reprogramming does not occur within the hours immediately following SCNT, but is a slow, ongoing process in the cloned embryo, and one that is likely not completed until the cells become committed to the inner cell mass lineage.[102]

> This creates a paradoxical situation in which cloned embryo nuclei must sustain and direct their own reprogramming toward totipotentiality during cleavage and beyond. One significant consequence of this is that the phenotype of cloned embryos will be distinct from that of normal embryos, and will likely vary with donor cell type. Thus, cloned embryos likely exist in a poor state of health in standard embryo culture media, and this situation may persist or even worsen upon transfer to the reproductive tract.[103]

It is not known whether the temporally protracted nature of reprogramming is an unavoidable part of cloning, or whether it could be overcome by improvements in the technology.[104] Improving the culture system might accelerate the pace of reprogramming, avoiding many of the epigenetic problems that are seen.[105]

Some scientists think that cloning problems such as low efficiency and abnormalities are not due to reprogramming at all. One study compared the gene expression profiles of cow embryos obtained by artificial insemination ("AI"), IVF, and SCNT, and found that the SCNT embryos had undergone significant reprogramming by the blastocyst stage.[106] Moreover, the cloned embryos resembled AI embryos much more closely than IVF embryos.[107] This suggests that the problems in cloning animals may not result from nuclear reprogramming, and that "problems may occur during redifferentiation for tissue genesis and organogene-

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[102] Latham, 72 Differentiation at 13 (cited in note 29).

[103] Id.

[104] Id.

[105] Id.

[106] Sadie Smith, et al, *Global Gene Expression Profiles Reveal Significant Nuclear Reprogramming by the Blastocyst Stage After Cloning*, 102 Proceedings Natl Acad Sciences 17582, 17582 (Dec 6, 2005). See also Nicole Johnston, *Cloned, Fertilized Embryos Look Alike*, 6 The Scientist (Nov 29, 2005), available at <http://www.the-scientist.com/article/display/22844/> (last visited May 10, 2006) (reporting on the study, noting that "[o]ne week after cloning (blastocyst state), [nuclear transfer] embryo expression profiles differed completely from the donor cells used to create them, indicating that nuclear reprogramming had been successful").

[107] Smith, 102 Proceedings Natl Acad Sciences at 17586 (cited in note 106).

sis, and small reprogramming errors may be magnified downstream in development."[108] Another theory is that poor efficiency and defects in cloned offspring might be the result not of imprinting errors, but of mitochondrial heteroplasmy, in which the embryo inherits mitochondria from two different individuals, instead of just the mother.[109]

Still another theory is that phenotypic anomalies could be due to the type of donor cell used. A study of cloned mice done by a group of Japanese scientists found that over 90 percent of newborn mice pups were normal, and that the paternal and maternal imprints on genes that direct embryonic development were faithfully maintained.[110] The expression of imprinted genes was found to be normal in cloned fetuses, although some placentas were larger than normal and did exhibit some epigenetic alterations.[111] The study suggested that previously reported abnormalities in cloned mice may have occurred because they were cloned from embryonic stem cells, instead of adult somatic cells.[112] When the mice were cloned from adult somatic cells, they were indistinguishable from controls.[113] "Epigenetic mutations accumulated during culture of [embryonic stem] cells, not the biological effects inherent to [SCNT], are therefore likely to have been the primary cause of anomalies in [embryonic stem] cell [nuclear transfer] clones . . . [embryonic stem] cells are perhaps a poor model with which to study [SCNT]."[114] One commentator noted that

> the amazing thing . . . is that this paper that said that cloning was safer than previously thought was published in a top scientific journal, *Science*, and it didn't even make it into the newspapers. . . . Dolly sneezes and its [sic] on the front page of the *New York Times*, but this paper saying clones are okay doesn't go anywhere. People don't want to hear this.[115]

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[108] Id at 17582.

[109] For a general discussion, see NAS Panel, *Human Reproductive Cloning* at 47-48 (cited in note 1) (discussing the potential problems related to mitochondrial heteroplasmy).

[110] Kimiko Inoue, et al, *Faithful Expression of Imprinted Genes in Cloned Mice*, 295 Science 297, 297 (Jan 11, 2002).

[111] Id.

[112] Id.

[113] Id.

[114] Inoue, et al, *Faithful Expression of Imprinted Genes*, 295 Science at 297 (cited in note 110).

[115] Lee Silver, *Public Policy Crafted in Response to Public Ignorance is Bad Public*

In sum, we do not yet know what causes the problems observed in cloned animals, whether they would occur in human beings, or how they might be prevented. Clearly, it would be irresponsible at this point to attempt to clone human beings, but with more research into cloning nonhuman mammals, the problems may be circumvented. This, then, leads to the next question:

C. How Safe is Safe Enough?[116]

Some of the literature suggests that human reproductive cloning would be ethically unacceptable if there were any chance of producing a child with a serious birth defect. For example, Cibelli, et al, argue that "until nuclear transfer is better characterized and understood–and the danger of generating a handicapped child *eliminated*—the unpredictability of the procedure strongly counsels against its application in human reproduction."[117] However, the danger of having a child with a disability will never be eliminated. Reproduction—natural or assisted—is not risk-free. Even ordinary sexual reproduction can result in miscarriage, stillbirth, birth defects, or maternal morbidity or mortality. So the issue should not be whether cloning is perfectly safe, but rather, how safe must cloning be in order to be ethically acceptable? According to Professor Macintosh, the animal data reveal that "an astonishing 77 percent of live born animals were healthy."[118] This may be "astonishing" to those convinced that all cloned animals must have serious defects. At the same time, a 77 percent rate of healthy offspring is not wonderful; a technique with a 23 percent rate of birth defects would not be medically or ethically acceptable for specialists in reproductive medicine.

If eliminating all risk is impossible, and a 23 percent risk of a serious defect is too high, what risk is acceptable? Some think the point of reference should be the rate of defects in ordinary nonmedically assisted reproduction.[119] Approximately 2-3 percent

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Policy, (transcribed remarks), 53 Hastings L J 1037, 1042-43 (2002).

[116] I take this heading from the title of Philip G. Peters' recent book, *How Safe Is Safe Enough? Obligations to the Children of Reproductive Technology* (cited in note 63).

[117] Cibelli, et al, 20 Nature Biotechnology at 14 (cited in note 40) (emphasis added).

[118] Macintosh, *Illegal Beings* at 58-59 (cited in note 2).

[119] See, for example, Peters, *How Safe is Safe Enough?* at 46 (cited in note 63) ("For decades, scholars have argued that infertility treatments should not be used if they impose risks that are significantly more serious than the risks associated with natural conception.").

of babies are born with a medically significant birth defect.[120] However, this also seems too stringent a standard, for "in vitro fertilization carries roughly twice the risk of major birth defects and low weight in term singleton babies, and no one seriously suggests that using in vitro fertilization is unethical."[121] A more reasonable comparison, it seems, is with current assisted reproduction technology ("ART"). The figure usually given is that over 95 percent of children born through ART are normal,[122] leaving a 5 percent risk of serious defect.

Suppose researchers managed to clone chimpanzees, our nearest relatives, with the risk of a serious defect below 5 percent. Would this be "safe enough" to begin clinical trials in humans? The President's Council thinks not.[123] In fact, the President's Council categorically opposes doing any research on reproductive cloning with human beings, because this would entail doing unjustifiable experiments on human beings.[124] "There seems to be no ethical way to try to discover whether cloning-to-produce-children can become safe, now or in the future."[125]

This is a startling conclusion. If all cloning research involving humans is unjustifiable experimentation, why is not all research on assisted reproductive techniques equally unethical? The President's Council responds that the analogy does not hold because "the case of cloning is genuinely different."[126] They argue that, unlike cloning, IVF is still sexual reproduction, the joining of two gametes "that nature has selected over millions of years for the entire mammalian line."[127] By contrast, cloning is asexual reproduction, which involves reprogramming.[128] That is true, but it is a description of cloning, not a reason why it can never ethically be shown to be safe. There does not seem to be a reason why of all new techniques, cloning should be the only one incapable of being shown to be safe enough to warrant trials with informed and willing human subjects.

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[120] *Birth Defects*, Medicinenet.com, available at <http://www.medicinenet.com/birth_defects/article.htm> (last visited Apr 19, 2006).

[121] Peters, *How Safe is Safe Enough?* at 47 (cited in note 63).

[122] E-mail communication from Paula Amato, M.D., Department of Obstetrics and Gynecology, Baylor College of Medicine (Oct 7, 2005).

[123] President's Council, *Human Cloning* at 92 (cited in note 13) ("Even a high success rate in animals would not suffice by itself to make human trials morally acceptable.").

[124] Id at 94.

[125] Id.

[126] Id.

[127] President's Council, *Human Cloning* at 93-94 (cited in note 13).

[128] Id at 94.

Another issue that has received a great deal of attention is whether any harm is done to a child by using a reproductive technique that causes the child to be born with a serious defect, if the child could not have been born otherwise. Many have argued that so long as the child has a life worth living, he or she has not been harmed or wronged by birth. Moreover, if the child has not been harmed or wronged, it is hard to see what wrong has been committed by those responsible for the child's birth. This complex issue is beyond the scope of this paper, but there can be very good reasons not to use techniques that will result in the birth of children with serious defects, even if those reasons do not refer to the child's having been wronged or harmed.[129]

While the safety objections are clearly important, they cannot justify a categorical, permanent ban on human reproductive cloning. Should modifications in techniques turn out to make cloning in other mammals, especially primates, relatively safe (in other words, as safe as other reproductive technologies), there could not be safety objections to attempting to clone human beings. I turn now therefore to:

II. NON-SAFETY OBJECTIONS

A. Easily Dismissed Objections[130]

Some of the objections to human reproductive cloning can be easily dismissed, such as the idea that human reproductive cloning is "playing God." All medical intervention is "playing God," in the sense that human intervention is changing the course of nature. By vaccinating children, by treating people with antibiotics, and by transplanting organs, we prevent the deaths of millions of people each year. It does not seem that there is any principled way to determine which of these practices counts as "playing God" and which do not—or as I prefer to put it, which instances of "playing God" are morally acceptable and which unacceptable. It seems that each new medical intervention is regarded with suspicion, as a human transgression on divine prerogative. This is true of organ transplantation, which is now an accepted part of

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[129] For an excellent review of the literature, see Peters, *How Safe is Safe Enough?* (cited in note 63). My most recent article on the topic is *Wrongful Life and Procreative Decisions*, in Matti Häyri, Tuija Takala, and Søren Holm, eds, *Life of Value: John Harris, His Arguments and His Critics* (Rodopi forthcoming 2006).

[130] I discuss these objections in my paper, *Cloning Human Beings: Sorting through the Ethical Issues*, in Barbara MacKinnon, ed, *Human Cloning: Science, Ethics, and Public Policy* 68 (Illinois 2000).

modern medicine. To the extent that the "playing God" objection simply reflects the unfamiliarity of a medical intervention, it is not a serious moral objection. On the other hand, if the objection is that we should be very careful about unforeseen and unwanted side effects of cloning, or any new technology, it deserves to be taken seriously. But if this is the correct interpretation of the "playing God" objection, it is only the safety objection restated.

Another easily dismissible objection to human reproductive cloning is that it would threaten the individuality of the cloned individual. This objection stems from a misunderstanding of what cloning is. It is not the creation of an exact copy of an individual, but rather that person's delayed genetic twin, no more a copy than identical twins are copies. They have the same genome, but they are not exactly alike, emotionally, mentally, or even physically; friends and relatives can usually tell them apart. To think that a clone would be a copy of the person who donates the somatic cell is to commit the fallacy of genetic determinism: that is, the fallacy of thinking that it is an individual's genome that is the sole determinant of what that person is or will be.[131]

There is a related objection, however, that is not so easily dismissible, and this has to do with the numbers of individuals cloned. It is one thing to have one identical twin; it is another to have a hundred. It would be unsettling, to say the least, to encounter dozens of individuals who had your genome. This might be a reason to limit the number of human clones created from any particular donor. This in turn suggests that the morality of cloning human beings may well turn on the reasons for doing it, as we will see in the next section.

B. Cloning and the Selection of Genetic Makeup

One concern expressed by the President's Council was that "[c]loned children would . . . be the first human beings whose entire genetic makeup is selected in advance."[132] The fear is that this would open the door to a future project of genetic manipulation and genetic control.

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[131] See NBAC, *Cloning Human Beings* at 32 (cited in note 5) ("Although genes play an essential role in the formation of physical and behavioral characteristics, each individual is, in fact, the result of a complex interaction between his or her genes and the environment within which they develop, beginning at the time of fertilization and continuing throughout life.").

[132] President's Council, *Human Cloning* at 104 (cited in note 13).

Cloning would enable people to know in advance their child's genome, which could be the reason why some people would choose to clone: to get a child with a particular genome. This might be done for egotistical ends, for example, by someone who thought that he or she was a particularly fine specimen of humanity that ought to be replicated. Or cloning might be used by people who want to raise a child with someone else's genome—for example, Michael Jordan's—because they want to be the parents of the next basketball superstar. Or cloning might be used to "replace" a dead or dying child.[133]

If those who use cloning expect to get an identical copy of the person cloned, they are likely to be greatly disappointed because, as noted above, a person's genome does not determine what that individual will be like emotionally, intellectually, or even physically. Michael Jordan's clone would undoubtedly be athletic, but there is no guarantee he would be good at or interested in basketball. He might be more interested in football or tennis or even (gasp!) ballet. To the extent that cloning is chosen because individuals believe that it can deliver a replica of the person cloned, it illustrates the fallacy of genetic determinism.

If reproductive cloning were to become safe and effective, it would be important not to mislead people into thinking that cloning would enable them to create a child "to spec." As Lee Silver put it, "all that anyone will ever get from the use of cloning, or any other reproductive technology, is an unpredictable son or daughter, who won't listen to his parents any more than my children will listen to me."[134]

Guarding against the fallacy of genetic determinism or the idea that cloning can create a replica would be especially important where the prospective parents were attempting to replace a dead or dying child. Grieving parents might believe or hope that cloning would enable them to have their child back again, and this is, of course, impossible.[135] For clinics or physicians to suggest otherwise would be the height of irresponsibility. However, it is possible that some people might want to clone a deceased child, even with a clear understanding of its limits, and full rec-

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[133] This has already been done with pets, so far cats only. Dog cloning is under development. In December 2004, Genetic Savings and Clone delivered a nine-week-old cat to its owner, at a cost of $30,000. Autumn Fiester, *Creating Fido's Twin: Can Pet Cloning Be Ethically Justified?*, 35 Hastings Center Report 34, 34 (July/Aug 2005). Current prices are around $32,000. *Cat Cloning*, Genetic Savings and Clone, Inc (cited in note 40).

[134] Silver, 53 Hastings L J at 1041 (cited in note 115).

[135] For an eloquent essay on this topic, see Thomas H. Murray, *Even if it Worked, Cloning Wouldn't Bring Her Back*, Wash Post, editorial, (April 8, 2001).

ognition of the environmental and in utero factors that influence personality, behavior, and even physical characteristics. Autumn Fiester has considered this with respect to the cloning of pets. Responding to the objection that pet cloning is a deceptive practice that exploits the grief of pet owners, she writes, "[t]he bereft pet owner might know full well that the clone will be nothing more than a genetic twin, and the decision to clone might be merely an attempt to preserve something important from the original animal, rather than *resurrect* it."[136] She suggests that the desire to clone a beloved pet is no more irrational than the desire to breed the pet.[137] It may be argued that this demonstrates precisely what would be wrong with cloning a human being; that in cloning a human being, we would be treating the individual as it is permissible to treat pets, as something less than full human beings possessing human dignity.

C. The Human Dignity Objection

The President's Council also offers a human dignity objection. Contrasting cloning with sexual procreation, the Council states:

> Parents beget a child who enters the world exactly as they did–as an unmade gift, not as a product. Children born of this process stand equally beside their progenitors as fellow human beings, not beneath them as made objects. In this way, the uncontrolled beginnings of human procreation endow each new generation and each new individual with the dignity and freedom enjoyed by all who came before.[138]

The idea here seems to be that whereas begetting creates a *child*, cloning creates a *product*, a thing, a made object. This turns children into things, violating Kant's dictum that we are never to treat others merely as means to our ends, that is, merely as things or tools or props to be manipulated.[139] But is

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[136] Fiester, 35 Hastings Center Report at 37 (cited in note 133).

[137] See id ("For animals that were neutered at an early age, who have no offspring, it is perfectly rational to desire the genetic 'starting blocks' Fido had, even under complete comprehension that this animal will not be Fido.").

[138] President's Council, *Human Cloning* at 105-06 (cited in note 13).

[139] For a general discussion, see Onora O'Neill, *Kantian Approaches to Some Famine Problems*, in Tom Regan, ed, *Matters of Life and Death: New Introductory Essays in Moral Philosophy* 285 (Random House 1980) (giving a brief introduction to Kant's ethics, including his categorical imperative).

this a fair objection? Would cloning create things instead of children? Would it be treating children as mere means to our ends?

It is important to emphasize that if cloning technology were developed to the point of being safe and effective in human beings, the clone would be a fellow human being, as much like you or I as Dolly was like other sheep. The cloned baby would not be a product or a thing or a made object, but a human being with the same human dignity accorded any other human being.[140]

However, the objection to cloning may not be that the cloned child would not be a fellow human being, but rather that the decision to clone suggests that the parents want a child with a specific genome, and that this in turn suggests an attempt to design the child. The attempt to design the child is what turns the child into a product. Parents are not supposed to want to design their children, nor is their love supposed to be contingent on the child's having certain traits or characteristics. Parents ought to accept their children for who they are. The attempt to select or control their genomes, and thus to some extent, their traits, is a form of parental tyranny. "When parents attempt to shape their children's characteristics to match their preferences and expectations, such an exercise of free choice on the parents' part may constrain their child's prospects for flourishing."[141]

While this objection has nothing to do with human dignity, it is not a trivial concern. It is important not to encourage parents to think that they can or should design their children, partly because this might constrain the child's development, and partly because the parents are likely to be disappointed, which may have further adverse effects on their ability to be good parents. However, it should be noted that many infertile couples already choose sperm and egg donors on the basis of traits they hope will be inherited by their offspring. Most often, they hope to get a child that "fits into" their family. Like adoptive couples, they seek to have a child similar to the child they would have had, but

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[140] See, for example, Rosen, *What Would a Clone Say?*, NY Times Sunday Magazine at 19 (cited in note 22) (arguing that clones would be just as human as the rest of us). By contrast, in the novel, *Never Let Me Go* (Knopf 2005), Kazuo Ishiguro imagines a society in which clones are created to be used as organ donors until they die. This is considered acceptable because the clones are viewed as not having souls. Ishiguro never explains the basis for this belief, and it seems just silly. (Incidentally, the clones he writes of are sterile, although in fact cloned mammals have not been sterile. Dolly had lambs. See Weiss, *Middle-Aged Dolly Develops Arthritis*, Wash Post at A03 (cited in note 47).).

[141] Thomas H. Murray, *Enhancement*, in Bonnie Steinbock, ed, *The Oxford Handbook of Bioethics* (Oxford, forthcoming 2007).

for their infertility. This selection of gametes has not led to parental tyranny, so it is unclear why cloning would.

Moreover, prospective parents might choose reproductive cloning not in attempt to get a child with a specific genome, but simply to have a child with whom they have a genetic connection.[142] Consider a couple who have not been able to have a child. Their infertility work-up reveals that the husband has severe male factor infertility. In other words, he has no viable sperm at all. Their physician recommends sperm donation. However, the couple is reluctant to bring a "third party" into their marriage. They want their child to be biologically "theirs." That is why they are not (yet) willing to consider adoption—just like most couples who undergo assisted reproduction. Imagine now that cloning has been shown to be safe and effective—as safe and effective as IVF. The man could provide a somatic cell, from which his DNA would be extracted and inserted into an enucleated egg cell from his wife. The resulting embryo would be implanted in her uterus for gestation. She would give birth to a son who would be genetically related to his father (albeit with a small amount of mitochondrial DNA from his mother) and biologically (gestationally) related to his mother. It is difficult to see anything in this scenario that makes it morally distinct from other forms of assisted reproduction. Moreover, when we consider this use of reproductive cloning, there is no danger of dozens of copies, since human parents typically only want a few children.

The idea that a reproductive technology can threaten or violate human dignity is puzzling, and requires us to think about what human dignity consists of. We may think of "dignity" as having to do with a certain demeanor: acting with formal, grave, or noble bearing. This sense of dignity has little to do with any aspect of reproduction, sexual or asexual. Another sense of dignity is related to the Kantian requirement of respect for persons.[143] Human dignity is clearly violated when people are tor-

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[142] See Robertson, 27 Hofstra L Rev at 618 (cited in note 16) (arguing that there may be "cases in which an infertile couple resorts to reproductive cloning because it is the only way for it to have a child genetically or biologically related to the rearing partners"). Drs. Neil Levy and Mianna Lotz maintain that a genetic connection between parents and children is overvalued and oppose reproductive cloning on the ground that it tends to encourage this over-valuation. Neil Levy and Mianna Lotz, *Reproductive Cloning and a (Kind of) Genetic Fallacy*, 19 Bioethics 232, 249 (2005). However, their objection is not specific to reproductive cloning, but applies equally to all ART. *Id.* This vitiates their objection since virtually no one who would like to see reproductive cloning banned is in favor of a general ban on ART.

[143] See O'Neill, *Kantian Approaches* at 288 (cited in note 139) (describing Kant's ethics as they relate to respect for persons).

tured, demeaned, or humiliated, since such treatment reduces them to mere means to someone else's ends. Less extreme forms of dignity-violation, such as deception, coercion, and exploitation, also treat people in a way to which they could not in principle consent, and thus violates Kant's second formulation of the categorical imperative.[144] But none of this has anything to do with methods by which children might be brought into the world. There is no reason why clones (or "monoparental children," as Silver prefers to call them[145]) would be treated any worse than children created by assisted reproductive therapy—and they might even be cherished more than children who are the accidental result of a one-night stand.

CONCLUSION

None of the nonsafety moral arguments against cloning is terribly persuasive. Either they are premised on the fallacy of genetic determinism–which should be rejected–or they are directed not against cloning itself, but against certain morally objectionable reasons for wanting to clone children, in other words, to get a child with certain specific traits. If the goal is simply to have a genetically related child, and due to gametic failure cloning is the only way to achieve this goal, it is difficult to see why cloning would be morally more suspect than other reproductive techniques. Other motives (for example, wanting a super-star athlete, attempting to replace a dead child) might be morally suspect, but such motives are not uniquely connected to cloning. Parents who force a child to become an athlete, or who treat a child as no more than a replacement for a dead child, are as blameworthy as individuals who use cloning to accomplish their purposes.

It seems then that the real problems with human reproductive cloning are safety-based. Clearly, at this point, the technology is not ready for prime time, and it would be irresponsible for any researcher to attempt to clone a human baby. However, as that may change, there is no justification for an absolute and permanent ban on human reproductive cloning, and ethics commissions ought to leave off suggesting that there is.

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[144] See id at 286 ("Act in such a way that you always treat humanity, whether in your own person or in the person of any other, never simply as a means but always at the same time as an end.").

[145] Silver, 53 Hastings L J at 1040 (cited in note 115).