TESTIMONY OF RICHARD M. DOERFLINGER

on behalf of the

PENNSYLVANIA CATHOLIC CONFERENCE

Subject: House Bill No. 2128, Imposing a ban on the cloning of human beings

House Judiciary Subcommittee on Crime and Corrections
The General Assembly of Pennsylvania

April 2, 1998

I am Richard M. Doerflinger, Associate Director for Policy Development at the Secretariat for Pro-Life Activities, National Conference of Catholic Bishops. I have been invited by the Pennsylvania Catholic Conference to testify on its behalf today regarding the moral challenge presented by human cloning and the need for a meaningful ban on the practice. Once H.B. 2128 incorporates its sponsor's technical amendments, conforming it to current Pennsylvania law against nontherapeutic fetal experimentation, it will represent such a meaningful ban.

The sanctity and dignity of human life is a cornerstone of Catholic moral reflection and social teaching. We believe a society can be judged by the respect it shows for human life, especially in its most vulnerable stages and conditions.

At first glance, human cloning may not seem to threaten respect for life. It is presented as a means for creating life, not destroying it. Yet it shows disrespect for life in the very act of generating it. Cloning completely divorces human reproduction from the context of a loving union between man and woman, producing children with no "parents" in the ordinary sense. Here human life does not arise from an act of love, but is manufactured to predetermined specifications.

A developing human being is treated as an object, not as an individual with his or her own identity and rights. As a group of experts advising the Holy See has written:

> In the cloning process the basic relationships of the human person are perverted: filiation, consanguinity, kinship, parenthood. A woman can be the twin sister of her mother, lack a biological father and be the daughter of her grandmother. *In vitro* fertilization has already led to the confusion of parentage, but cloning will mean the radical rupture of these bonds.[1]

Some of our country's most respected philosophers and ethicists have expressed similar objections. Writes Professor Leon Kass of the University of Chicago:

> Human cloning would... represent a giant step toward turning begetting into making, procreation into manufacture (literally, something "handmade")... [W]e here would be taking a major step into making man himself simply another one of the man-made things.[2]

From the dehumanizing nature of this technique flow many disturbing consequences. Because human clones would be produced by a means more suited to primitive, subhuman forms of life -- involving no loving relationship, no personal investment or responsibility for a new life, but only laboratory technique -- they would be uniquely at risk of being treated as "second-class" human beings.

The very scenarios often cited as <u>justifications</u> for human cloning are actually <u>symptoms</u> of the moral problem it creates. It has been said that cloning could be used to create "copies" of illustrious people, or to replace a deceased loved one, or even to provide a source of spare tissues

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[1]Reflections from the Pontifical Academy for Life, "Human Cloning Is Immoral" (July 9, 1997), in *The Pope Speaks*, vol. 43, no. 1 (January/February 1998), p. 29. Also see: Congregation for the Doctrine of the Faith, *Donum Vitae* (Instruction on Respect for Human Life in its Origin and on the Dignity of Procreation)(March 10, 1987), I.6 and II.B.

[2]Leon R. Kass, "The Wisdom of Repugnance," in *The New Republic*, June 2, 1997, p. 23.

or organs for the person whose genetic material was used for the procedure. In each proposal we see a utilitarian view of human life, in which a human being is treated as a means to someone else's ends instead of as a person with his or her own inherent dignity. This same attitude lies at the root of human slavery.

Let me be perfectly clear. In reality a cloned human being would not be, in any sense, an "object" or a substandard human being. Whatever the circumstances of his or her origin, he or she deserves to be treated as a human person with an individual identity. But the depersonalized technique of manufacture known as cloning disregards this dignity and sets the stage for further exploitation. Cloning is not wrong because cloned human beings lack human dignity -- it is wrong because they have human dignity, and deserve to come into the world in ways that respect this dignity.

Ironically, the most startling evidence of the dehumanizing aspects of cloning is found in some proposals ostensibly aimed at preventing human cloning. The National Bioethics Advisory Commission (NBAC), and now some members of Congress, favor legislation that would not ban human cloning at all -- but would simply ban any effort to allow cloned human beings to survive. In these proposals, researchers are allowed to use cloning for the unlimited mass production of human embryos for experimentation -- after which they are required to destroy them, instead of allowing them to implant in a woman's womb.

Enactment of such a proposal would mark the first time in history that the U.S. government defined a class of human beings that it is a crime not to destroy. These human embryos -- produced without true parents, and hence without protectors -- would be created at the outset for the sole purpose of experimentation and destruction.

This approach is condemned by pro-life groups as a "clone-and-kill" approach -- because it allows unlimited creation of human embryos for research purposes, so long as they are ~~not~~ destroyed. Many biotechnology and pharmaceutical companies nevertheless favor such an approach, claiming that the embryos to be killed are of no account and that promising medical benefits may arise from such experimentation. Yet the American people have already spoken out forcefully against such misuse of human embryos.

Over three years ago the National Institutes of Health proposed that federally funded researchers be allowed to perform nontherapeutic experiments on human embryos produced by in vitro fertilization -- including embryos produced solely for research purposes. The moral outcry against this proposal was almost universal. Opinion polls showed massive opposition, and the NIH panel making the recommendation was inundated with over 50,000 letters of protest. The *Washington Post,* while reaffirming its stand in favor of legalized abortion, editorialized against the Panel's recommendation:

> The creation of human embryos specifically for research that will destroy them is unconscionable... [I]t is not necessary to be against abortion rights, or to believe human life literally begins at conception, to be deeply alarmed by the notion of scientists' purposely causing conceptions in a context entirely divorced from even the potential of reproduction.[3]

President Clinton ultimately set aside the recommendation allowing creation of "research embryos," and Congress for the past three years has voted to prohibit all harmful embryo research -- most especially the creation of "research embryos" -- at the National Institutes of Health.

In fact, Pennsylvania and some other states have gone further, making it a felony to perform "any type of nontherapeutic experimentation" on a human embryo from the point of

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[3]Editorial, "Embryos: Drawing the Line," *The Washington Post*, October 2, 1994, C6.

fertilization onward (18 Pa. Cons. Stat. Ann. §§3203, 3216). What the biotechnology industry is proposing is that human embryos produced by cloning be singled out for destructive experiments **that would be a felony if performed on any other human embryo**.

It is absurd to propose that morality and state law must be turned on their heads, and that the special creation and destruction of human embryos should be approved for research purposes, simply because that embryo is produced by cloning. Ironically, It seems the cloning procedure is so demeaning that people somehow assume that a brief life as an object of research, followed by destruction, is "good enough" for any human produced by this technique. The fact that the procedure invites such morally irresponsible policies is reason enough to ban it.

It is morally wrong to *make* a human clone, not to *be* a human clone. Certainly, the innocent victim of cloning should not be subjected to a death penalty -- yet this is what occurs when a state allows creation of cloned embryos for research purposes while banning their survival to live birth. With Rep.Yewcic's technical amendments, H.R. 2128 will avoid this trap and offer a genuine and much-needed ban on human cloning.

The NBAC or "clone-and-kill" approach does not even make sense as a barrier to cloning for reproductive purposes. For a great deal of destructive experimentation using cloned human embryos would be a necessary step toward the production of a live-born infant by cloning. As many as 276 sheep embryos, fetuses and newborn lambs had to die so that one sheep, "Dolly," could be produced. Scientists now say that hundreds or thousands of unborn humans may die to produce one live-born human clone -- indicating that it would be morally irresponsible to make the attempt. Yet the NBAC approach would give the government's blessing to such experiments. Researchers who discard hundreds or thousands of human embryos in failed cloning attempts

could resort to the defense that such cavalier disposal of human life is what the law requires.

Some will ask: Are we really speaking here of a human embryo, let alone a human life? Yet even the NIH Human Embryo Research Panel, which recommended federal funding for destructive human embryo experiments, called the early human embryo "a developing form of human life" which "warrants serious moral consideration."[4] If some wish to deny membership in the human family to human beings in the earliest stage of their development, it is they who impose an ideological filter on the facts.[5] To say that one is banning "human cloning" by simply banning the nurture or live birth of cloned human embryos is to distort language and common sense.

Research involving the cloning of animals, plants, and even human genes, tissues and cells (other than embryos) can be beneficial to human beings and presents no intrinsic moral problem. However, when research turns its attention to human subjects, we must be sure that we do not undermine human dignity in the very process of seeking to serve it. Human experimentation divorced from moral considerations may well progress more quickly on a technical level -- but at the loss of our sense of humanity.

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[4]*Final Report of the Human Embryo Research Panel* (National Institutes of Health: September 27, 1994), p. 2. Tragically, the Panel gave no real weight to this insight in its final policy recommendations.

[5]While some fertility specialists have used the term "pre-embryo"to describe the first 14 days of human development, a scientific expert who strongly supports embryo research recently wrote that this term was embraced "for reasons that are political, not scientific." The term "pre-embryo," he writes, "is useful in the political arena -- where decisions are made about whether to allow early embryo (now called pre-embryo) experimentation..." Biologically, in the human species and others, an embryo exists from the one-celled stage onwards. See Lee Silver, *Remaking Eden: Cloning and Beyond in a Brave New World* (Avon Books 1997), p. 39. Also see the factsheets, "What is an Embryo?", NCCB Secretariat for Pro-Life Activities, 2/26/98, and "Does Human Cloning Produce an Embryo?", Id., 3/31/98.

There has been much speculation in recent months about the ways human cloning might revolutionize medical research on various diseases. In all these areas of research, however, alternatives seem to be possible which do not involve the use of cloning technology to create and destroy human embryos. For example, some researchers may want to use somatic cell nuclear transfer to create "customized stem cell lines" genetically matched for individual patients -- a procedure that in each case would require creating, developing and then killing a human embryo that is the patient's identical twin. Yet even the National Bioethics Advisory Commission described this avenue of research as "a rather expensive and far-fetched scenario," and reminded us that a moral assessment is necessary as well:

> Because of ethical and moral concerns raised by the use of embryos for research purposes it would be far more desirable to explore the direct use of human cells of adult origin to produce specialized cells or tissues for transplantation into patients.[6]

One great benefit of a ban on human cloning is that it will direct the scientific enterprise toward research that benefits human beings without forcing them to produce, exploit and destroy fellow human beings to gain those benefits. Creating human life solely to cannibalize and destroy it is the most unconscionable use of human cloning -- not its highest justification.

In light of these concerns we urge the enactment of H.R. 2128, amended to conform to current state law against destructive experiments on human embryos.

Thank you for your attention. I would be glad to answer any questions.

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[6]*Cloning Human Beings: Report and Recommendations of the National Bioethics Advisory Commission* (Rockville, MD: June 1997), pp. 30-31. The Commission here outlined three alternative avenues of stem cell research, two of which seem not to involve creating human embryos at all. Also see the factsheet, "Would a Ban on Human Cloning Block Stem Cell Research?", NCCB Secretariat for Pro-Life Activities, 3/31/98.

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What is an Embryo?

Though produced in a new and bizarre manner, a cloned embryo grows and develops as a living organism in the same way as one produced by fertilization. Writes Professor Lee Silver of Princeton University: "Cloned children will be full-fledged human beings, indistinguishable in biological terms from all other members of the species. Thus, the notion of a soulless clone has no basis in reality" (*Remaking Eden: Cloning and Beyond in a Brave New World*, New York: Avon Books 1997, p. 107). To claim that an embryo produced by cloning is not really an embryo, in order to justify destructive experimentation on it, is arbitrary and "self-serving" (Embryologist Jonathan Van Blerkom of University of Colorado, in *American Medical News*, Feb. 23, 1998, p. 32).

Some proponents of destructive embryo research try to deny moral status to *all* early human embryos. They have coined the term "pre-embryo" to describe human embryos in the first two weeks of development, seeking to justify destructive experimentation during this early stage. However, the term and concept of "pre-embryo" has never been accepted by Congress, the National Institutes of Health's Human Embryo Research Panel, or the National Bioethics Advisory Commission, and is rejected by contemporary textbooks on embryology.

The following references illustrate the fact that a new human embryo, the starting point for a human life, comes into existence with the formation of the one-celled zygote:

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"Development of the embryo begins at Stage 1 when a sperm fertilizes an oocyte and together they form a zygote."

[England, Marjorie A. *Life Before Birth*. 2nd ed. England: Mosby-Wolfe, 1996, p.31]

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"Human development begins after the union of male and female gametes or germ cells during a process known as *fertilization* (conception).

"Fertilization is a sequence of events that begins with the contact of a *sperm* (spermatozoon) with a *secondary oocyte* (ovum) and ends with the fusion of their *pronuclei* (the haploid nuclei of the sperm and ovum) and the mingling of their chromosomes to form a new cell. This fertilized ovum, known as a *zygote*, is a large diploid cell that is the beginning, or *primordium, of a human being*."

[Moore, Keith L. *Essentials of Human Embryology*. Toronto: B.C. Decker Inc, 1988, p.2]

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"Embryo: the developing organism from the time of fertilization until significant differentiation has occurred, when the organism becomes known as a fetus."

[*Cloning Human Beings*. Report and Recommendations of the National Bioethics Advisory Commission. Rockville, MD: GPO, 1997, Appendix-2.]

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"Embryo: An organism in the earliest stage of development; in a man, from the time of conception to the end of the second month in the uterus."

[Dox, Ida G. et al. *The Harper Collins Illustrated Medical Dictionary.* New York: Harper Perennial, 1993, p. 146]

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"Embryo: The early developing fertilized egg that is growing into another individual of the species. In man the term 'embryo' is usually restricted to the period of development from fertilization until the end of the eighth week of pregnancy."

[Walters, William and Singer, Peter (eds.). *Test-Tube Babies.* Melbourne: Oxford University Press, 1982, p. 160]

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"The development of a human being begins with fertilization, a process by which two highly specialized cells, the *spermatozoon* from the male and the *oocyte* from the female, unite to give rise to a new organism, the *zygote*."

[Langman, Jan. *Medical Embryology.* 3rd edition. Baltimore: Williams and Wilkins, 1975, p. 3]

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"Embryo: The developing individual between the union of the germ cells and the completion of the organs which characterize its body when it becomes a separate organism.... At the moment the sperm cell of the human male meets the ovum of the female and the union results in a fertilized ovum (zygote), a new life has begun.... The term embryo covers the several stages of early development from conception to the ninth or tenth week of life."

[Considine, Douglas (ed.). *Van Nostrand's Scientific Encyclopedia.* 5th edition. New York: Van Nostrand Reinhold Company, 1976, p. 943]

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"I would say that among most scientists, the word 'embryo' includes the time from after fertilization..."

[Dr. John Eppig, Senior Staff Scientist, Jackson Laboratory (Bar Harbor, Maine) and Member of the NIH Human Embryo Research Panel -- Panel Transcript, February 2, 1994, p. 31]

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"The development of a human begins with fertilization, a process by which the *spermatozoon* from the male and the *oocyte* from the female unite to give rise to a new organism, the *zygote*."

[Sadler, T.W. *Langman's Medical Embryology*. 7th edition. Baltimore: Williams & Wilkins 1995, p. 3]

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"The question came up of what is an embryo, when does an embryo exist, when does it occur. I think, as you know, that in development, life is a continuum.... But I think one of the useful definitions that has come out, especially from Germany, has been the stage at which these two nuclei [from sperm and egg] come together and the membranes between the two break down."

[Jonathan Van Blerkom of University of Colorado, expert witness on human embryology before the NIH Human Embryo Research Panel -- Panel Transcript, February 2, 1994, p. 63]

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"*Zygote*. This cell, formed by the union of an ovum and a sperm (Gr. *zygōtos*, yoked together), represents the ***beginning of a human being***. The common expression 'fertilized ovum' refers to the zygote."

[Moore, Keith L. and Persaud, T.V.N. *Before We Are Born: Essentials of Embryology and Birth Defects*. 4th edition. Philadelphia: W.B. Saunders Company, 1993, p. 1]

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"The chromosomes of the oocyte and sperm are...respectively enclosed within *female* and *male pronuclei*. These pronuclei fuse with each other to produce the single, diploid, 2N nucleus of the fertilized *zygote*. This moment of zygote formation may be taken as the beginning or zero time point of embryonic development."

[Larsen, William J. *Human Embryology*. 2nd edition. New York: Churchill Livingstone, 1997, p. 17]

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"Although life is a continuous process, fertilization is a critical landmark because, under ordinary circumstances, a new, genetically distinct human organism is thereby formed.... The combination of 23 chromosomes present in each pronucleus results in 46 chromosomes in the zygote. Thus the diploid number is restored and the embryonic genome is formed. The embryo now exists as a genetic unity."

[O'Rahilly, Ronan and Müller, Fabiola. *Human Embryology & Teratology*. 2nd edition. New York: Wiley-Liss, 1996, pp. 8, 29. This textbook lists "pre-embryo" among "discarded and replaced terms" in modern embryology, describing it as "ill-defined and inaccurate" (p. 12}]

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"Almost all higher animals start their lives from a single cell, the fertilized ovum (*zygote*)... The time of fertilization represents the starting point in the life history, or *ontogeny*, of the individual."

[Carlson, Bruce M. *Patten's Foundations of Embryology*. 6th edition. New York: McGraw-Hill, 1996, p. 3]

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"[A]nimal biologists use the term *embryo* to describe the single cell stage, the two-cell stage, and all subsequent stages up until a time when recognizable humanlike limbs and facial features begin to appear between six to eight weeks after fertilization....

"[A] number of specialists working in the field of *human* reproduction have suggested that we stop using the word *embryo* to describe the developing entity that exists for the first two weeks after fertilization. In its place, they proposed the term *pre-embryo*....

"I'll let you in on a secret. The term pre-embryo has been embraced wholeheartedly by IVF practitioners for reasons that are political, not scientific. The new term is used to provide the illusion that there is something profoundly different between what we nonmedical biologists still call a six-day-old embryo and what we and everyone else call a sixteen-day-old embryo.

"The term pre-embryo is useful in the political arena -- where decisions are made about whether to allow early embryo (now called pre-embryo) experimentation -- as well as in the confines of a doctor's office, where it can be used to allay moral concerns that might be expressed by IVF patients. 'Don't worry,' a doctor might say, 'it's only pre-embryos that we're manipulating or freezing. They won't turn into *real* human embryos until after we've put them back into your body.'"

[Silver, Lee M. *Remaking Eden: Cloning and Beyond in a Brave New World*. New York: Avon Books, 1997, p. 39]

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DOES HUMAN CLONING PRODUCE AN EMBRYO?

In February 1997, Dr. Ian Wilmut and his team startled the scientific world by showing that the nucleus from an adult sheep's body cell could be used to produce a developing embryo that would grow into another, genetically identical sheep. There was no doubt whatever that this process ("somatic cell nuclear transfer") produces an **embryo** of the relevant species. As Dr. Wilmut said in his groundbreaking article: "The majority of reconstructed **embryos** were cultured in ligated oviducts of sheep... Most **embryos** that developed to morula or blastocyst after 6 days of culture were transferred to recipients and allowed to develop to term," etc. [I. Wilmut et al., "Viable offspring derived from fetal and adult mammalian cells,"385 *Nature* 810-813 (Feb. 27, 1997)]

Now that the discussion has turned to humans, political spokespersons for the biotechnology and pharmaceutical industries have decided to engage in a curious avoidance of the fact that somatic cell nuclear transfer using a human nucleus would produce a human embryo. There seem to be two reasons for this:

(a) some spokespersons maintain -- contrary to scientific evidence, the findings of the NIH Human Embryo Research Panel, and current federal law on embryo research -- that **no** human embryos should be called "embryos" for the first two weeks of existence.[1]

(b) because cloned embryos are seen as such useful research material for destructive experiments, current restrictions on embryo research etc. must be evaded by denying that an embryo produced by cloning deserves the name.

Thus euphemisms and misleading or inaccurate terms ("totipotent cell," "clump of embryonic cells," "unfertilized oocyte," etc.) have entered the political discussion. They are employed to conceal the fact that researchers want to be allowed to use cloning to produce and destroy human embryos. Biotechnology groups claim to oppose the cloning of "human beings" or "persons" -- but they reserve the right to conduct cloning experiments on human embryos and fetuses, so long as none is allowed to survive to live birth.

Fortunately, one can cut through the political evasions by looking at the professional literature -- including writings by those who *support* cloning of embryos for research purposes:

"One potential use for this technique would be to take cells -- skin cells, for example -- from a human patient who had a genetic disease... You take these and get them back to the beginning of their life by nuclear transfer into an oocyte to produce **a new embryo**. From that **new embryo**,

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[1]On this broad claim, now conceded even by proponents of embryo research to be based on political rather than scientific concerns, see the separate factsheet "What is an Embryo?", NCCB Secretariat for Pro-Life Activities, 2/26/98.

you would be able to obtain relatively simple, undifferentiated cells, which would retain the ability to colonize the tissues of the patient." - Ian Wilmut, in 7 *Cambridge Quarterly of Healthcare Ethics* 138 (Spring 1988)

[On being asked in an interview: "Do you think that society should allow cloning of **human embryos** because of the great promise of medical benefit?"]: "Yes. Cloning at the **embryo** stage -- to achieve cell dedifferentiation -- could provide benefits that are wide ranging..." - Keith Campbell, head of embryology at PPL Therapeutics and co-author of Dr. Wilmut's landmark paper, in 7 *Cambridge Quarterly of Healthcare Ethics* 139 (Spring 1988)

"Yet there is nothing synthetic about the cells used in cloning... The newly created **embryo** can only develop inside the womb of a woman in the same way that all **embryos** and fetuses develop. Cloned children will be full-fledged human beings, indistinguishable in biological terms from all other members of the species. Thus, the notion of a soulless clone has no basis in reality." - Lee M. Silver, professor of molecular biology and evolutionary biology at Princeton University, in *Remaking Eden: Cloning and Beyond in a Brave New World* (Avon Books 1997), p. 107

"The Bond-Frist bill in the Senate and the Ehlers bill in the House... would ban all cloning in **human-embryo** research..." - J. Kassirer and N. Rosenthal, in 338 *New England J. of Medicine* 906 (March 26, 1998)

"This experiment [producing Dolly] demonstrated that, when appropriately manipulated and placed in the correct environment, the genetic material of somatic cells can regain its full potential to direct **embryonic**, fetal, and subsequent development." - National Institutes of Health, Background paper "Cloning: Present uses and Promises," Jan. 29, 1998, p. 3

"The Commission began its discussions fully recognizing that any effort in humans to transfer a somatic cell nucleus into an enucleated egg involves the **creation of an embryo**, with the apparent potential to be implanted *in utero* and developed to term." - *Cloning Human Beings: Report and Recommendations of the National Bioethics Advisory Commission* (Rockville, MD: June 1997), p. 3

[Listing research proposals that "should not be funded for the foreseeable future" because of "serious ethical concerns"]: "Such research includes: ... Studies designed to transplant embryonic or adult nuclei into an enucleated egg, including nuclear cloning, in order to duplicate a genome or to increase the number of **embryos** with the same genotype, with transfer." - Final Report of the Human Embryo Research Panel, National Institutes of Health, Sept. 27, 1994, p. 12

[Expressing disbelief that some deny that human cloning produces an embryo]: "If it's not an **embryo**, what *is* it?" - Jonathan Van Blerkom, human embryologist at University of Colorado, in *American Medical News*, Feb. 23, 1998, p. 32 (Dr. Van Blerkom said researchers' efforts to avoid the word "embryo" in this context are "self-serving.")

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WOULD A BAN ON HUMAN CLONING BLOCK STEM CELL RESEARCH?

Some biotechnology companies claim that a ban on producing human embryos through cloning would stall important research in generating "stem cells" to cure a variety of diseases [*Cong. Record*, 2/5/98, S425]. To put this claim in perspective:

1. Cloning is desired as a source of "customized stem cell lines" which would be an exact genetic match to each individual patient with a given disease. But this would require each individual patient to undergo somatic cell nuclear transfer to produce one or many living human embryos who genetically are the patient's identical twin sisters or brothers. These embryos would then be destroyed to provide embryonic stem cells.

Two methods of obtaining the cells have been described. In the simplest, the embryo is allowed to develop normally for a week or two to the blastocyst stage, at or after the usual time of implantation in the mother's womb; then this embryo, consisting of hundreds of cells, is dissected for its stem cells. The other avenue is to introduce molecular signals into the embryo's environment to "trick" its cells into departing from normal development and instead producing "a mass of undifferentiated tissue," which can then be reprogrammed into various kinds of cells [Lee Silver, *Remaking Eden: Cloning and Beyond in a Brave New World* (Avon Books 1997), p. 128]. In either case, the living embryo is destroyed.

2. This avenue for providing medical benefits has been described even by supporters as "largely conjectural" (J. Kassirer and N. Rosenthal, in *New England Journal of Medicine*, March 26, 1998, p. 905). President Clinton's National Bioethics Advisory Commission called it "a rather expensive and far-fetched scenario." The Commission observed: "**Because of ethical and moral concerns raised by the use of embryos for research purposes it would be far more desirable to explore the direct use of human cells of adult origin to produce specialized cells or tissues for transplantation into patients.**" The Commission outlined three alternative avenues for promising research using stem cells that do not involve human cloning, two of which do not require human embryos at all (*Cloning Human Beings: Report and Recommendations of the National Bioethics Advisory Commission,* June 1997, pp. 30-31).

The Commission's Alternatives

The alternatives outlined by President Clinton's Commission are as follows:

1. Generating "a few, widely used and well characterized human embryonic stem cell lines, genetically altered to prevent graft rejection in all possible recipients." This would raise its own ethical objections because it may involve producing and destroying some human embryos at the outset; but it does not require somatic cell nuclear transfer, or the creating and destroying of genetically related embryos for each individual patient.

2. Stimulating "proliferation and differentiation of the quiescent stem cells which are known to exist in many adult tissues, including even the nervous system." Such stem cells could be "customized" to each individual patient and would not be from embryonic sources.

3. Identifying "methods by which somatic cells could be 'de-differentiated' and then 're-differentiated' along a particular path." This would permit "the growth of specialized cells compatible with a specific individual person for transplantation." While at present this option is considered speculative, its feasibility is now enhanced by the central finding of the research that produced "Dolly" the sheep: An adult body cell can be "de-differentiated" surprisingly easily and regressed all the way back to a stage at which it can provide the nucleus for a new developing embryo. The question is: Can this regression be done to a point short of this, so an adult cell becomes the basis for cells that are like embryonic stem cells but never came from an embryo?

Other Alternatives (not explicitly cited by the Commission)

4. There are other promising sources of pluripotent (not embryonic) stem cells for treatment of disease. One example is hematopoietic (blood cell producing) stem cells from bone marrow or even from the umbilical cord blood in live births. These cells are already widely used in cancer treatment and in research on treating leukemia and other blood diseases. Their versatility was recently found to be even greater than once thought. For example, given the right environment bone marrow cells can be used to regenerate muscle tissue, opening up "a whole avenue of potential therapies that didn't exist before" for muscular dystrophies ("Bone Marrow Cells May Provide Muscle Power," *Science*, 6 March 1998, p. 1456).

5. An enormously promising new source of stem cells is fetal bone marrow, which is "23 times more effective than adult marrow and eight times better than umbilical cord blood." Recent studies show that "miscarriages can provide enough cells for transplantation if we would collect them effectively and store them in banking" ("Fetal marrow transplants promising against disease," *Detroit News*, May 4, 1997). A stem cell line from such sources could provide a continuous supply of stem cells for research. It seems fetal bone marrow cells do not provoke the same immune reactions as adult or even newborn infant cells. This is true whether the unborn child is the donor or the recipient -- that is, fetal cells can be used to treat adults, or adult bone marrow cells can be used to treat a child in the womb, without harmful immune reactions (see Jack Goldberg, "Fetal stem cell therapy," in Jauniaux et al. (eds.) *Embryonic Medicine and Therapy* [Oxford U. Press 1997], pp. 474-80).

6. Other approaches to tissue regeneration involve the growth factors (activators and inhibitors of cell division and growth) responsible for the development of various cell types and tissues. These factors may be used to manipulate the cells of a tissue along the spectrum of differentiation, without the need to create stem cells first. Use of these factors has already shown promise in the clinical setting, as a vascular growth factor has been successful in saving the life of a patient who had lethal blood clots in one leg: Application of the growth factor allowed new vessels to grow around the clots and restore circulation to the leg. Now such factors have been used to generate

new blood vessels to human hearts in 20 patients ("Drug Stimulates Growth of Heart Blood Vessels," *Washington Post Health*, Feb. 24, 1998, p. 5).

7. Cells of different kinds are now being genetically engineered to repair damaged organs, especially by injecting them with the "oncogene" (a type of gene that causes cancer cells to reproduce rapidly). Heart cells produced with this gene can "survive and beat like normal heart muscle cells" when transferred to a damaged heart ("Study: Cells Repair Heart Damage," Associated Press, March 17, 1998).

8. Methods are being developed for growing entire replacement organs, to treat children before or after birth. Cells of the needed variety are extracted from the child and cultured, then grown into organs in the laboratory using biodegradable scaffolds. The researchers say they hope to receive FDA approval for routine use of the technology within five years. They add that "there are no ethical concerns doing this treatment, as there are about some other procedures [such as human cloning]" ("Doctors grow animal organs," *Washington Times*, July 23, 1997, pp. A1, A18; also see Ben Bova, "Lost a lung? Grow your own," in *USA Today*, Feb. 24, 1998).

9. Promising avenues have been opened up in research on cancer and diseases of aging by studies of telomerase, dubbed by some "the immortality enzyme." It protects and rebuilds telomeres, the protective caps on the ends of chromosomes which deteriorate as we age. It is now believed that the uncontrolled growth of cancerous tumors is driven by telomerase. Mastering this enzyme may enable researchers to (a) inhibit its activity in cancer cells to shut down tumorous growth, and (b) to use telomerase itself in a controlled way to help rejuvenate and regenerate damaged tissues and organs. (J. Madeleine Nash, "The Immortality Enzyme," *Time*, Sept. 1, 1997)

In short: The claim that human embryo cloning is needed to advance promising medical research in cancer, degenerative diseases, etc. is simply false.

It is **possible** (though there is no firm evidence for this) that use of somatic cell nuclear transfer to create and cannibalize human embryos will enable **more rapid** development of **some** limited branches of research. On this point we might consider the words of Professor Patricia King, co-chair of the NIH Human Embryo Research Panel:

"The fertilization of human oocytes for research purposes is unnerving because human life is being created solely for human use.... In particular, **the public should be assured that embryos will not be created because such creation is the most convenient means of answering important scientific questions that can be answered -- perhaps more slowly -- in other ways.**" [*Final Report of the Human Embryo Research Panel* (NIH, Sept. 27, 1994), p. 97]

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