

THE CLONING DEBATE: THE FUTURE IS BURDENED BY ITS PAST

THE CONFLICT

Science has brought the capacity to clone human embryos within reach. In the early twenty-first century, the question is whether or not research on human cloning should be allowed, and if so, for what purpose. For instance, stem cell research is one of the most promising breakthroughs of modern medicine, but stem cells come from newly fertilized human eggs and the use of them is considered murder by some. However, stem cells could be harvested from clones of these eggs, and many support this use of cloning. Cloning for the purpose of creating human beings, however, is a matter for which most scientists do not believe we are ethically, socially, or scientifically prepared.

Political

- The act of genetic engineering can, and has, led to discrimination against those who do not fit in the “right” category. From simply being denied health insurance to being interned in concentration camps for posing a “threat to the gene pool,” the social consequences of reproductive cloning are frightening.

Economic

- Because it is potentially a very profitable business, some fertility clinics are already preparing to use human reproductive cloning to help infertile couples. The technological capacity exists and it will be difficult to stop fertility doctors from cloning human beings. The ethical and social issues will probably not be well met with market (business) solutions.

On November 25, 2001, Advanced Cell Technology, a Massachusetts research company, announced that it had produced a human embryo clone for the purpose of medical research. Although the mastering of the technique of human cloning has been widely anticipated, the news created an international stir. The science involved in cloning has outpaced the legal mechanisms to regulate it. While bans on cloning prevail throughout much of the world, controversy over whether the ban on human cloning should be inclusive, or if therapeutic uses should be encouraged, is widespread.

By the end of 2003 the Human Genome Project (HGP) is scheduled to have completed its project of characterizing all human genetic material by determining the complete sequence of the DNA (deoxyribonucleic acid) in the human genome. (The genome of an organism is its set of chromosomes, containing all of its genes and associated DNA.) The goal of this project is to discover all of the more than thirty thousand human genes so that they are available for biological study. Geneticists have mapped the genomes of many plant and animal species as well, but the human genome is particularly important, mostly because the complete map is the most detailed family portrait that the human race can ever have.

The most often-stated purpose for understanding the human genome is the prevention and treatment of disease. Some horrific diseases, such as cancer, multiple sclerosis, diabetes, and schizophrenia, carry a genetic predisposition. For example, because a parent has the gene for cancer, he or she might pass it on to a child, which in turn would give that child a genetic predisposition (though not a genetic certainty) to develop cancer, the likelihood of which would depend on other environ-

CHRONOLOGY

1798 English mathematician, statistician, and economist Thomas Malthus publishes “An Essay on the Principle of Population” in which he argues that the earth can provide only limited resources and therefore populations of any living thing, including humans, will naturally compete for those limited resources. Darwin will later take up this idea in his theory of evolution.

1849 Charles Darwin publishes *The Origin of the Species by Means of Natural Selection*, in which he proposes that the evolution of humankind is the process of gradual change and development throughout the ages by a process of natural selection.

1865 Gregor Mendel writes a paper entitled “Experiments with Plant Hybrids,” which will be all but ignored until the turn of the twentieth century, and which describes the method by which traits pass from one generation to the next.

1892 August Weismann publishes *The Germ-Plasm: A Theory of Heredity*, which expands on theories of evolution and natural selection but proves that traits can not be acquired in one generation.

late 1800s The theory of “Social Darwinism” is born, and with it a new phrase coined by English philosopher Herbert Spencer: “the survival of the fittest.”

1913 Behaviorism, the psychological science that emphasizes environmental factors as the root of be-

havior and success rather than genetic ones, is introduced.

1920s Eugenics organizations spring up around the United States and elsewhere.

1930s–40s During the Holocaust in Europe, 12 million people are murdered in the name of eugenics and Social Darwinism.

1997 Scientists in Scotland produce the first successful clone of a complex mammal—Dolly, the sheep—and cloning becomes a branch of genetic science.

December 14, 1998 Researchers at Kyeonghee University in Korea announce they have cloned a human, but because their work was for the purpose of creating organs for transplant, they did not implant the cell into a human uterus.

November 25, 2001 American research firm Advanced Cell Technology (ACT) announces that it has created a human embryo clone.

January 2002 The National Academy of Sciences recommends a ban on human cloning for reproductive purposes but supports therapeutic cloning.

2003 The Human Genome Project (HGP) is scheduled to complete its project of characterizing all human genetic material by determining the complete sequence of the DNA (deoxyribonucleic acid) in the human genome.

mental and health variables. Recognizing the existence of these genetic predispositions can help doctors treat—perhaps even eliminate—some terrible diseases. Such treatment is called gene therapy.

Gene therapy is, according to Nelson Wivel of the Institute of Human Gene Therapy, a method of “treating diseases based on modifying the expression of a person’s genes toward a therapeutic goal” (available on the World Wide Web at <http://www.uphs.upenn.edu/ihgt/info/whatisgt.html>). By correcting a disease at the level of DNA molecules, gene therapy attempts to compensate for the abnormal genes. There are two kinds of gene therapy: somatic gene therapy and germline gene therapy. Somatic gene therapy manipulates gene expression to help the patient, but does not extend to maintaining the correction for any of the pa-

tient’s future descendants. This is the type of therapy pursued by most laboratories. Germline gene therapy deals with modifying gene cells so that only specific characteristics are passed on to offspring. Research in this area is more ethically ambiguous and is less widespread.

Gene therapy involves a type of cell called a stem cell. Each cell of the human body carries the complete genetic information of the entire person. But, shortly after fertilization, each cell in the body begins to specialize. Some become nerve cells, others muscle cells, fat cells, and so forth. Once a cell has taken on a specific function, it can no longer be transformed into another type of cell. Cells that have not yet specialized are called stem cells.

Stem cells have the potential to be the most important biological tool in the hands of doctors

since the discovery of antibiotics because stem cells can turn into any kind of cell. This is especially important for the treatment of victims of nerve damage or of diseases that destroy cells in great quantities. Nerve damage is currently basically untreatable because, unlike other cells in the body, nerves do not regenerate.

If stem cells can be coaxed into being nerve cells, those suffering paralysis from nerve damage can be given back their mobility, victims of ocular cell damage can regain their sight, and so on. Diabetes, Parkinson's, and other similar diseases can now only be controlled; there are no cures. Thousands die every year from diseases that stem cell therapy could eradicate. If any cell in the body can be regenerated, then victims of horrible accidents, crimes, diseases, and wars can be made whole again.

Why would anyone be opposed to research with such a beneficial intent? Opposition to genetic research is generated by where stem cells come from: newly fertilized human eggs. Since 1973 and the Supreme Court case on abortion, *Roe v. Wade*, a bitter political debate has been waged over the definition of the time when human life begins, whether at conception (fertilization) or some later point. If human life (itself a difficult term to define) begins at conception, some will argue, then destroying that life to harvest stem cells is murder. If life begins later, then harvesting stem cells from a zygote (the egg fertilized by sperm is called a zygote) is politically and morally acceptable.

The debate becomes even more complex when the idea of reproductive cloning is introduced. Cloning is a technique of genetic engineering in which an offspring is produced asexually—that is, the egg and the sperm never join. The offspring that results has the exact same genes as its donor organism. Reproductive human cloning is the term used for the cloning procedure from which human offspring is intended as the result. Stem cells can also be harvested from the clone, something that resembles a zygote. The difference, however, is that cells that grow from eggs fertilized by sperm, i.e. made by two people, are zygotes; clones come from one, unfertilized cell. Reproductive cloning was once thought to be the answer to the controversy over using stem cells, but harvesting cells from a clone still destroys the potentiality of human life, even if that potential life was not naturally created.

Every day this debate changes because science makes new discoveries. A late-proposed solution to the stem cell harvesting question comes from fertility clinics that have been creating (as part of normal fertility therapy) zygotes that are, accord-

ing to researchers Mina Alikani and Dr. Steen M. Willadsen of the Institute for Reproductive Medicine and Science (quoted by Gina Kolata in her 1998 book *Clone: The Road to Dolly, and the Path Ahead*), too “aberrant” to be implanted. “Destroying these ‘chimeric’ embryos to get stem cells might not be objectionable to opponents of most stem cell research, the researchers said, since the chimeras were created from embryos with ‘virtually no chance’ of becoming a baby.”

Cloning raises issues other than stem cell research, however. Many evils have resulted from the shortage of organs donated for transplant, such as some people in the third world selling their own organs on the black market, and doctors being forced to choose who will live and who will die based on the availability of organs. Cloning can eliminate these social evils. Scientists are able to harvest a patient's own DNA and grow a replacement organ, a cloned organ that genetically matches the host. Such an organ will not be subject to the body's rejection, and no one will have to go untreated because of a shortage in organ donations.

Most importantly, organs will no longer be harvested from healthy, live people to fill the need. This use of cloning is called therapeutic cloning. But, before it can be used, the science of cloning itself must progress. That is the issue before the world—whether or not research on human cloning should be allowed. The history behind the cloning headlines follows three paths: scientific, political, and ethical, and, as in most matters of great gravity to the human race, the three are nearly inseparable.

HISTORICAL BACKGROUND

Some might say that it all started in Scotland with a sheep named Dolly, the product of the first successful attempt to clone a complex mammal. Before Dolly's birth, cloning as a branch of genetic science was relegated more to the realm of science fiction than scientific fact. But Dolly and each clone like her are exact genetic reproductions of a single adult parent (twins are clones too, but of each other). In and of itself, the fact of a cloned sheep in the Scottish highlands might not be the cause of too much alarm, but, with the successful cloning of a mammal, there was considerable concern about the possible abuses of such cloning in the future, and horrors of the past were brought to bear on the matter. Cloning sheep is not what scares most people; rather, the possibility of cloning a human being gives many scientists, politicians, and ethicists pause.

Before Charles Darwin's publication of the *Origin of Species by Means of Natural Selection* in 1849 created an intellectual explosion in the scientific and intellectual communities around the world, there were few alternatives to the religious view that the creation of humankind was a divine act, accomplished by the most powerful of beings—a god. Advocates of the creationist view of human history viewed the complexity of the world and the universe as evidence that only an omnipotent being could create and maintain such magnificent order. The ideas of randomness and change as determining, and even creative, factors in the development of humankind were difficult to accept. Darwin proposed that the evolution of humankind was the process of gradual change and development throughout the ages by a process of natural selection.

Notwithstanding humankind's need to believe in the divineness of its own origins, humans had, for millennia, manipulated the traits they found desirable in both animals and in plants; husbandry and horticulture—together known as domestication—were the first attempts by humans to favor or discourage with their intelligence the characteristics and traits of other life on earth. Darwin only suggested that nature made the choices based on adaptation and survival, and humans, as mammals, were subject to the same types of pressures that had created change in the rest of the biological world.

Husbandry is the practice of intentionally breeding animals to either spread or eliminate a desired trait. Horticulture has the same goal but is the term used for breeding plants. For example, if an animal keeper decides that sheep with white wool are more desirable (because it is more easily dyed than black wool), he or she will not allow a black sheep to mate with a white one. After observing sheep mating for many sheep generations, the animal keeper will understand that only black sheep will produce black sheep—maybe in one, two, or three generations—but white sheep that have never been bred with black sheep will never produce black lambs. He or she need be no geneticist to understand this (although we now know this is because the gene that causes blackness in wool is a recessive one).

Husbandry has been a tool of humans since the origins of settled civilization. Its appearance in ancient archaeological sites, along with horticulture, is one criterion by which anthropologists determine whether a civilization existed or whether the site only supported a group of hunters and gatherers. Husbandry and horticulture are two defining characteristics of civilization itself. The enormity of



DOLLY THE SHEEP, THE WORLD'S FIRST CLONED MAMMAL, LOOKS THROUGH THE BARS OF A PEN. DOLLY LAUNCHED A HIGH PROFILE, PUBLIC DEBATE ABOUT THE ETHICS OF CLONING. (Getty Images. Reproduced by permission.)

Darwin's theory was to suggest that adaptation to environmental niches and preservation or conservation of traits happened, not with intelligent guidance by God or man, but rather by the random, amoral need to survive. Natural selection did not need to breed the "best," "strongest," or most "moral" specimen; only the one best *adapted* to its surroundings will survive, breed, and pass on the trait that allowed survival.

Evolutionary biologist Stephen Jay Gould made the case best in *Wonderful Life: The Burgess Shale and the Nature of History* (1991). To paraphrase his argument, a prehistoric fish might have been supremely adapted to being a fish; he might even have been the best fish that ever swam in the earth's waters. But if an ice age ended, a meteor struck the earth, or a long drought occurred and dried up the water—or in other words, the environment to which the fish was adapted suddenly changed—our highly adapted, successful fish would perish, while the reptile who had struggled in cold water might then immediately begin to thrive in a warm, dry climate. A mature theory of evolution proffers that change to individuals and species occurs over time, and random events caused that change, not the hand of God. (Certainly it has been possible for religions and the theory of evolution

CLONING TERMS

Cloning is a technique of genetic engineering in which an identical genetic “twin” is produced asexually (without joining egg and sperm). This “twinning technique” is achieved by taking an unfertilized egg from an adult female and removing all of its genetic information-containing DNA, leaving it an empty egg ready to support growth. A cell is then removed from the adult to be cloned and is raised in a growth medium designed to “turn off” its specialized genes and make it think it is an embryo cell. This donor cell is fused electrically with the egg cell, and the artificially fertilized egg starts to divide into an embryo. Transplanted into the womb of a surrogate mother, the egg develops and results in an offspring that is genetically identical to the organism that donated the cell.

Embryonic **stem cells** are “generic” cells of a human being (or other organism). Because they are not specialized, they are capable of becoming all or many of the 210 different kinds of tissues in the human body and can make exact copies of themselves indefinitely. They are useful for medical and research purposes because they can produce cells for almost every tissue in the body. Adult stem cells are not as useful for research as embryonic stem cells because they are specific to certain cell types, such as blood, intestines, skin, and muscle. Embryonic stem cells are obtained from aborted

fetuses or fertilized eggs that are left over from in vitro fertilization (IVF). In order to extract the embryonic stem cell, it is necessary to destroy the host embryo. That is why using cloned human embryos to create a supply of stem cells for therapeutic uses is appealing to many researchers.

Genetic blueprints. The first complete sequencing of an organism’s genetic makeup was accomplished by the Institute for Genomic Research in 1995. They sequenced all 1.8 million base pairs—the rungs of the DNA double helix and the letters of the genetic alphabet—that make up the single circular chromosome of the bacterium *Haemophilus influenzae*. The next year an international team of scientists created the genetic blueprint of an organism similar to human cells. They identified all of the more than six thousand genes that control reproduction, life, and death in yeast cells. For the first time, scientists had access to the full set of genetic instructions in a complex cell. The instructions for making and maintaining a yeast cell are encoded in 12,057,000 “letters” of code which, in turn, are packed into about six thousand genes on sixteen chromosomes. Human instructions are contained in about three billion such “letters” in about eighty thousand genes on forty-six chromosomes.

to coexist in harmony. To many people holding to a strong religious conviction regarding the evolution of life, God might have caused the drought that brought about the change.)

The mistake that Darwin made was in assuming the method by which new traits—ones that allowed survival in changed circumstances—were acquired and then passed onto subsequent generations. Darwin, through observation on his voyage aboard the HMS *Beagle*, had witnessed all sorts of marvelous and exotic creatures in habitats undisturbed by humans, in places like the Galapagos Islands. There he found creatures so highly adapted and specialized for such specific environmental conditions that they could not live anywhere else on earth. How did these traits come to exist in these discreet populations?

Darwin had read the ideas of evolution of French naturalist Jean-Baptiste Lamarck (1744–1829). According to David Clifford of Cambridge

University in the article “Jean-Baptiste Lamarck (1744–1829),” “the overarching component of Lamarckian evolutionism was what became known as the inheritance of acquired characters. This described the means by which the structure of an organism altered over generations. Change occurred because an animal passed on to its offspring physiological changes it had undergone in its own lifetime, and those changes came about by its responding to its survival needs.” For example, the giraffe that stretched its neck the highest to eat the best leaves would, after years of doing that, have offspring with longer necks. Lamarck’s theories were disproved by the work of August Weismann (1834–1914) in his 1892 book *The Germ-Plasm: A Theory of Heredity*. Weismann believed in the theories of evolution and natural selection. But he proved that traits could not be acquired in one generation. As opposed to Lamarck’s idea that new traits occurred when an animal passed on physiological changes it had undergone to its offspring, with the

birth of the science of genetics, science learned that mutation was the source of new traits, thus adding another level of randomness to biological history.

The Birth of Genetics

Farmers and shepherds over thousands of years who practiced husbandry and horticulture knew that they were manipulating traits of the organisms that they bred. Black versus white wool, fat versus lean cattle, large versus small kernels of corn; their intent was to better feed their people and to insure the survival of the group by altering nature to increase resources in the struggle to survive. But the concept of individual genetic structure was unknown to those who manipulated genes in order to produce desired traits in their herds and gardens. Even Charles Darwin, the father of the theory of evolution, was unaware of small sequences of proteins formed on a structure called—because of its geometric shape—a double-helix that carried all of the information for all living creatures on earth. Nor did he know that every cell in every body has the complete map for creating an exact duplicate of itself.

The existence of genes and the science of genetics were unknown before the work of an obscure, quickly forgotten nineteenth-century German monk named Gregor Mendel (1823–84). Mendel gave a paper in 1865 on his discoveries, but he was all but ignored until the turn of the twentieth century, when August Weismann's ideas led to the rediscovery of Mendel's laws, although Weismann himself was unaware of them. In his short paper, "Experiments with Plant Hybrids," Mendel described the method by which traits passed from one generation to the next, thereby confirming Darwin's observations.

Although known as the father of the science of genetics, Mendel was not a famous scientist. His remarkable contribution to the study of biology was one of observation: he was the first person to trace the characteristics of successive generations of a living thing. The child of farmers in Brunn, Moravia, Mendel taught high school students as an Augustinian monk. Mendel's attraction to research was based on his love of nature. He was not only interested in plants but also in meteorology and theories of evolution.

Having read Darwin's *The Origin of Species*, Mendel often wondered how plants obtained atypical characteristics, which Darwin thought were acquired through repetitive behavior and what we now know are mutative. On one of his frequent walks around the monastery, he found an atypical variety of an ornamental plant. He took it and

planted it next to the typical variety. He grew their progeny side by side to see if there would be any approximation of the traits passed on to the next generation. He wanted to test the theories of Lamarck, on whom Darwin had relied. Mendel found that the plants' respective offspring were nearly identical to the parents, and therefore were not influenced by the environment. This simple test gave birth to the idea of heredity.

Mendel then came up with the idea of what we now call dominant and recessive genes and set out to test it in peas. Patient observation was Mendel's most important asset. It took seven years to cross cultivate and record the results to a degree where the tests could be confirmed in order to prove the laws of inheritance. From his studies, Mendel derived certain basic laws of heredity: hereditary factors do not combine, but are passed intact; each member of the parental generation transmits only half of its hereditary factors to each offspring (with certain factors "dominant" over others); and different offspring of the same parents receive different sets of hereditary factors. Mendel's careful observation and reporting became the foundation for modern genetics.

Central to Darwin's theory of the struggle to survive were the notions that more individuals are born than can survive on naturally occurring resources and that populations will compete for these limited resources. These ideas came from English mathematician, statistician, and economist Thomas Malthus (1766–1834) who, in 1798, published a paper titled "An Essay on the Principle of Population." Darwin took these ideas to mean that the individuals that were most well adapted to their environments would be the most successful in the struggle, and those who could not adapt, or, retroactively integrating Mendel's work, those who were not born with the genes that gave them an edge, would lose the battle for limited resources. The winners would live; the losers would die; such is the inevitable outcome of natural selection.

Genetics and Ethics: Eugenics

In the early twentieth century, the rediscovery of Mendel's laws of genetics, in addition to the proliferation of Darwin's theory of evolution and its adoption of Malthusian laws of population, had a cultural and political effect. While Darwin had only studied animals in the wild, where resources were truly limited, the bundle of scientific theories that had come to be known as the theory of evolution had been seized in England and in the United States. Here, they were applied to human populations in industrialized societies where resources



SOUTH KOREAN ENVIRONMENTAL ACTIVISTS PROTEST AGAINST A MEDICAL TEAM'S DEVELOPMENT OF CLONING HUMAN CELLS TO MAKE REPLACEMENT ORGANS. (Photograph by Ahn Young-joon. AP/Wide World Photos. Reproduced by permission.)

were overly abundant but artificially limited to certain populations.

Although human technology effectively removed the human race from the process of natural selection written about by Darwin, the theory of "Social Darwinism" was nonetheless born, and with it came a new phrase coined by English philosopher Herbert Spencer (1820–1903): "the survival of the fittest." The definition of the word "fittest" had dramatic consequences for millions of human beings in the twentieth century. What was meant by fittest? Who would define it?

"Social" sciences were new in the late nineteenth century. The fact that human intelligence could be applied to engineering society as it had been applied to building cities and curing illnesses was a new idea. Social engineering became a way to make real the desire for a utopian future, one without the ravages that rocked the industrial world of the early twentieth century: poverty, disease, overcrowding, disparity in wealth, pollution, and war. Consequently, the new science of genetics—in addition to disciplines that utilized "scientific" methodology such as economics, history, architectural planning, and horticulture—was put to use in the service of society. One path of genetic research, the pseudo-science of eugenics, branched off into the shadows of social theory and in the first quarter of the twentieth century became immensely popular.

Eugenics was presented as a mathematically determined science that could be used to predict the traits and behaviors of humans, and, in a perfect world, to control human breeding so that only people with the "best" genes would reproduce and thus generally improve the species. If the tenets of Social Darwinism were true and only the fittest would survive, the next logical step would be to eliminate "bad" traits and preserve "good" ones. It was an optimistic school of thought with a profound, almost overwhelming faith in the powers of science.

Even in its day, many people saw that eugenics was a frightening, pseudo-scientific discipline, riddled with inconsistencies. But it was championed by very prominent and respected biologists, and its conclusions told many people what they wanted to hear: that certain "racial stock" was superior to others in traits valued in the Progressive Era, such as intelligence, hard work, cleanliness, sobriety, fidelity, and physical strength and beauty. Local eugenics societies and groups sprang up around the United States after World War I (1914–18), with names such as the Race Betterment Foundation. World War I had given many Americans a greater fear of foreigners, and the immediate (but short-lived) postwar economic depression stirred a xenophobic fear of foreigners "taking" jobs that "belonged" to Americans or intermarrying and reducing the hearty "American" racial stock. The Ku Klux Klan reemerged as a force in American politics during the 1920s, spreading not just hatred of African Americans but of immigrants, Jews, Catholics, and anyone else they found to be dissimilar to themselves.

Not only did eugenicists promote better breeding, they wanted to *prevent* poor breeding or the

risk of it. That meant keeping people with “undesirable” traits in their heritage, even traits not genetically predisposed, separate from others or, where law allowed, preventing them from reproducing. The phenomenon even went so far as to allow for the legal sterilization of those who were determined to be “feeble-minded.” Even the revered Supreme Court Justice Oliver Wendell Holmes ruled that forced sterilization of “imbeciles” was appropriate for the sake of society.

Vocal anti-immigrant groups that advocated nativism and racial purity were effective in having laws passed to attain their aims; in 1924, the Immigration Act was passed by majorities in the U.S. House and Senate. It set up strict quotas limiting immigrants from countries believed by eugenicists to have “inferior” stock, particularly southern Europe and Asia. President Calvin Coolidge, who signed the bill into law, had stated when he was vice president, “America should be kept American. . . . Biological laws show that Nordics deteriorate when mixed with other races.”

According to historian R. J. Lambrose in the 2002 *Radical History Review* article “Look Away, Look Away,” the Virginia legislature passed a resolution in February 2001 “expressing ‘profound regret’ for the state’s involvement in a eugenics-driven sterilization program that led to the sterilization of 7,450 Virginians ‘in the name of purifying the white race.’” The sterilization law, similar to the one the Nazis passed in Germany in 1933, was enacted in 1924 and also outlawed interracial marriages. Laws prohibiting interracial marriage were found to be unconstitutional in 1967, but the Virginia eugenics statute was finally repealed only in 1979.

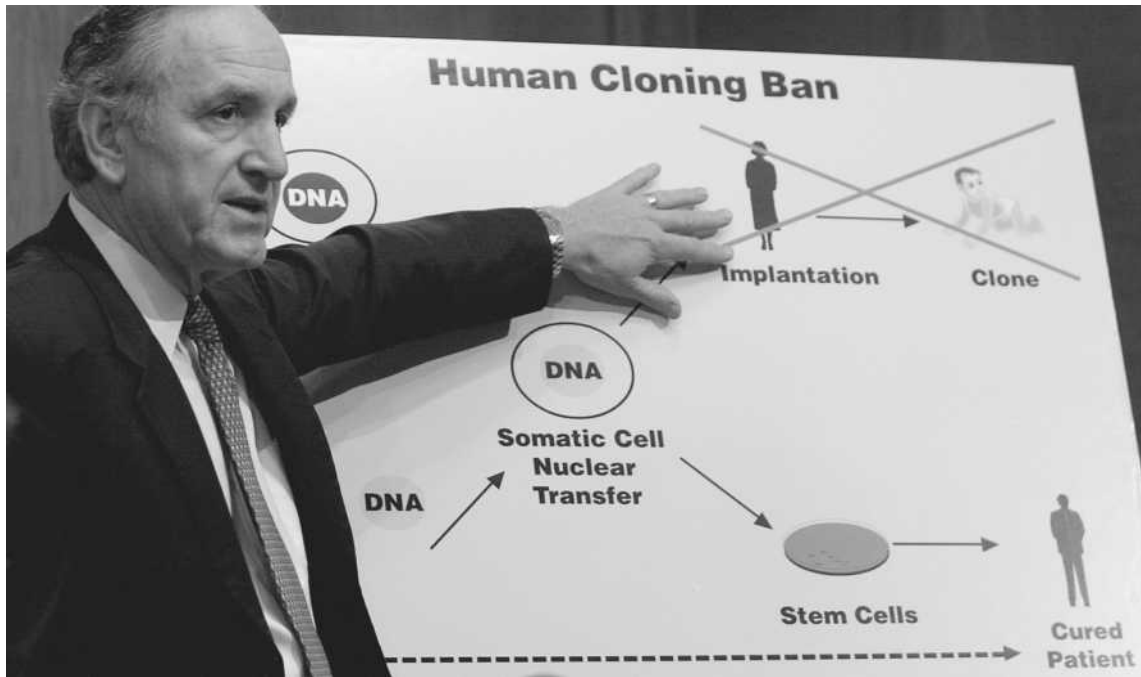
Behaviorism, the psychological science that emphasizes environmental factors as the root of behavior and success rather than genetic ones, was introduced in 1913. After World War I, few scientists joined the ranks of the eugenicists. As the weight of the scientific community shifted toward behaviorism and true genetics, popular opinion followed. Articles about childrearing and self-improvement popularized behaviorism and environmental factors in growth and human potential and deemphasized genetic predetermination still further. The eugenics craze was already fading when the horrors of institutionalized eugenics were revealed in Nazi Germany during World War II and eugenicists became silent, though eugenic sentiments were not yet eradicated. The specter of eugenics, which is now recognized to be akin to racism and white supremacy, is raised by the genetic manipulation called reproductive cloning.

Eugenics, or the creation of a biological “master race,” was the basis of the genocidal rhetoric of madmen like Adolf Hitler. The “Final Solution” of the Third Reich was a mass attempt to rid the “Aryan” race of “inferior” genes, those of Jews, gypsies, homosexuals, the infirm, and anyone else who threatened the dominance of perfect Nordic whiteness, the mythological heritage of Germany. Well over 12 million people were murdered in the 1930s in the name of eugenics and Social Darwinism. In the twenty-first century, to advocate scientifically altering the genetic development of a child in order to create some socially defined exemplar of perfection calls forth the institutional memory of death camps and forced sterilization.

RECENT HISTORY AND THE FUTURE

On November 25, 2001, an American research firm, ACT or Advanced Cell Technology, announced that it had created a human embryo clone. The announcement was made in an online science journal, *The Journal of Regenerative Medicine*. ACT described the process that had been used, including encouraging human eggs to begin dividing on their own in the asexual process known as parthenogenesis. The striking news, according to many commentators, was that the human egg could divide on its own; the production of a human embryo clone was very much expected. In fact, as far back as 1998, researchers in South Korea claimed to have produced a human embryo clone. ACT assured the public that the clone would only be used for medical purposes. “Our intention is not to create cloned human beings, but rather to make life-saving therapies for a wide range of human disease conditions, including diabetes, strokes, cancer, AIDS, and neurodegenerative disorders such as Parkinson’s and Alzheimer’s disease,” said ACT vice president Robert Lanza, as quoted in the November 26, 2001, BBC news article “Controversy over Human Embryo Clone.”

In contrast to ACT and the medical use of the human embryo clone, some fertility clinics in the early 2000s are technologically prepared to enter into the business of human reproductive cloning. For them, the purpose *is* to create human beings. And many in the scientific world believe it is too late to stop them from proceeding with this work, no matter how ill-prepared the world is for the results. Princeton geneticist Lee Silver addressed this issue in the PBS Frontline interview “Human Cloning: How Close Is It?”: “Cloning is certainly going to emerge from the fertility clinics that exist



U.S. SENATOR TOM HARKIN SPEAKS AT A SENATE SUBCOMMITTEE HEARING ON HUMAN CLONING. HARKIN INTRODUCED A BILL IN 2002 THAT WOULD BAN HUMAN REPRODUCTIVE CLONING BUT WOULD ALLOW THE CLONING OF HUMAN EMBRYOS FOR MEDICAL RESEARCH. (Photograph by Dennis Cook. AP/Wide World Photos. Reproduced by permission.)

in this country and elsewhere around the world, because it's only in the fertility clinics where the technology exists from taking eggs out of a woman's ovary, developing the eggs in a petri dish and putting the embryos back into a woman's uterus. That is done at fertility clinics. It is not done at biotech companies . . ." Silver went on to say that even with strong regulations against human cloning, it is likely that some clinics will just go ahead and do it. It will be a very profitable business.

Two fertility doctors have been constantly in the news with plans to use human cloning to help infertile people. Since 1998, Italian embryologist Severino Antinori, who ran a fertility clinic in Rome, has drawn attention to his work in human cloning. Antinori had previously been known for his work in *in vitro* fertilization. In 1994 he implanted a donor's fertilized egg into the uterus of a 63-year-old woman, who then became the oldest woman ever known to give birth. His partner, U.S. cloning researcher Panos Zavos, split off to work on his own amid media assertions that Antinori had already made a woman pregnant with the world's first human clone. Zavos said that the assertions about Antinori were not true, but also suggested that he himself might be the first to accomplish the feat. Both are considered by most scientists as publicity seekers, but that they could

already be implanting clones in infertile women is not unlikely.

Although the kind of human reproductive cloning Antinori and Zavos are working on is not legal in Europe or the United States, their claims have created much concern in the scientific world. People who have worked in animal cloning were particularly critical of the efforts to produce human clones. There were 277 attempts made before Dolly, the first cloned sheep, was produced. The dangers to an impregnated woman and to the embryo are very high—miscarriage, stillbirth, and deformity or other abnormality is likely. Even if the science is sound, there is no consensus on the social and ethical issues that cloning humans would entail.

Efforts to ban human cloning are urgent because the scientific capacity to produce a human clone has preceded consideration of the issues and of the safety of the procedure. In the summer of 2002, the main issue is whether all human cloning will be banned, or if research can continue with cloning for medical purposes. The National Academy of the Sciences in January 2002 recommended that human reproductive cloning done for the purpose of making a human baby should be banned and that the issue should be taken up again in five years if there is public interest. The Academy did

not want the ban on human reproductive cloning to extend to cloning embryos for the purpose of extracting stem cells for medical use, which it held very useful for medicine.

In the United States, President George W. Bush took a stand against all human cloning, including medical research, on the principle that cloning means taking one life (the embryo) for the benefit of another. His is the standard pro-life approach. The U.S. Senate is not readily going along with the idea of a total ban; many wish to keep the medical research options open.

Although many of the countries in the European Union have banned human cloning at a national level, the EU itself has not banned it. In the United Kingdom, the distinction is being made between implanting embryo clones into wombs to impregnate women, which is banned, and therapeutic cloning and stem cell research, which are not.

Although therapeutic cloning bothers those who believe that all human cells have the potentiality to grow into a human being, reproductive cloning is far more worrisome to many more people. Therapeutic cloning creates a bundle of specialized cells that do not have the potentiality to become independent human life. To create an exact replica of oneself without the randomness introduced by nature reminds many of the biological engineering of the early twentieth century. A perfect duplicate is as much one person's decision of what is perfect as was the decision to exterminate sources of "imperfect" genetic information.

The act of genetic engineering can, and has, led to discrimination against those who do not fit in the "right" category. From relatively simple consequences such as being denied health insurance to more radical dangers such as being interned in concentration camps as a threat to the gene pool, the social consequences of reproductive cloning are frightening. History has taught us that the science and technology to manipulate human evolution for relativistic political, social, and cultural ideas of perfection is indeed a path fraught with danger.

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