THE CQ Researcher

PUBLISHED BY CONGRESSIONAL QUARTERLY INC.

◆ WINNER, SOCIETY OF PROFESSIONAL JOURNALISTS AWARD FOR EXCELLENCE

# 'Designer' Humans

*Will altering human genes divide society?*

Recent advances in biotechnology have brought the prospect of genetically altering human beings much closer to reality. But ethicists argue that altering an embryo's genetic blueprint to make a baby smarter or healthier — or prettier — would destroy what it means to be human. There is also concern that genetically endowing children with selected traits will create a social divide between those who can and cannot afford the procedure. But proponents argue that genetically enhancing people will not devalue their humanity, just make them potentially smarter and healthier. They also dispute the notion of a "genetic divide," noting that the rich already have a variety of means — from private schools to top-flight health care — to give their children advantages. Recent hearings on Capitol Hill continued the debate.

INSIDE

## THIS ISSUE



CQ May 18, 2001 • Volume 11, No. 19 • Pages 425-440

# 'DESIGNER' HUMANS



Cover: Recent biotechnology advances have brought the prospect of genetically altering human beings much closer to reality. But many question the ethics of creating made-to-order babies. (Corbis Images)


THE *CQ Researcher*

**May 18, 2001**
**Volume 11, No. 19**

**MANAGING EDITOR**
Thomas J. Colin

**ASSISTANT MANAGING EDITOR**
Kathy Koch

**STAFF WRITERS**
Mary H. Cooper
Brian Hansen
Kenneth Jost
David Masci

**PRODUCTION EDITOR**
Olu B. Davis

**ASSISTANT EDITOR**
Scott D. Kuzner

**CQ PRESS**
**A Division of Congressional Quarterly Inc.**

**SENIOR VICE PRESIDENT / GENERAL MANAGER**
John A. Jenkins

**DIRECTOR, LIBRARY PUBLISHING**
Kathryn Suarez

**DIRECTOR, OPERATIONS**
Sandra D. Adams

**CONGRESSIONAL QUARTERLY INC.**

**CHAIRMAN**
Andrew Barnes

**VICE CHAIRMAN**
Andrew P. Corty

**PRESIDENT AND PUBLISHER**
Robert W. Merry





The CQ Researcher (ISSN 1056-2036) is printed on acid-free paper. Published weekly, except Jan. 5, June 29, July 6, July 20, Aug. 10, Aug. 17, Nov. 30 and Dec. 28, by Congressional Quarterly Inc. Annual subscription rate for libraries, businesses and government is $500. Single issues are available for $10 (subscribers) or $20 (non-subscribers). Quantity discounts apply to orders over 10. Additional rates furnished upon request. Periodicals postage paid at Washington, D.C., and additional mailing offices. POSTMASTER: Send address changes to The CQ Researcher, 1414 22nd St., N.W., Washington, D.C. 20037.

# 'Designer' Humans

BY DAVID MASCI

## THE ISSUES

With his big eyes and spiky hair, ANDi might look like any other baby rhesus monkey, but he is far from ordinary. On Jan. 11, scientists in Oregon unveiled ANDi as the first genetically altered primate.

In an experiment that took scientists a step closer to eventually genetically altering humans, the researchers spliced a gene from a jellyfish into a rhesus monkey embryo, which was then fertilized and implanted into a surrogate mother. Thus, at birth ANDi carried the new gene in his genome, or genetic blueprint.

Newsmakers/Oregon Regional Primate Research Center

*ANDi — whose name is the acronym for "inserted DNA" spelled backwards — is the world's first genetically modified primate. The baby rhesus monkey has genes from a jellyfish, which were inserted as a "marker" so researchers could see if the experiment worked.*

ANDi is not the first genetically engineered mammal. It joins several other species — including mice, sheep and pigs — with altered genomes. But ANDi's birth is significant, because as a primate, he is among mankind's closest relatives. "We've gone from mice to monkeys, and it's pretty easy to see who's next," says Eric Kleiman, research director for In Defense of Animals, in Mill Valley, Calif.

But a recent groundbreaking fertility experiment in New Jersey may have already accidentally altered the human gene pool. New Jersey fertility doctor Jacques Cohen recently announced that a technique he has used to impregnate infertile women had unintentionally caused at least two babies to be born with genes from two mothers and one father. Because the children's offspring will inherit traits from both mothers, it marks the first time researchers have altered the human germline — sperm or egg cell genes that will be passed on to future generations.

Cohen and his colleagues acknowledged as much when they touted their experiment in a British medical journal as "the first case of human germline genetic modification resulting in normal healthy children." [1]

Although the group said any genetic changes resulting from their technique would be miniscule, others said it was symbolically profound. "They have breached a wall that had been erected by scientists, geneticists and doctors who said they would never do germline genetic change," said Arthur Caplan, director of the Center for Bioethics at the University of Pennsylvania. "This is an ethically momentous shift." [2]

The American Association for the Advancement of Science last year had called for a self-imposed ban on such gene-altering fertility work until a government oversight panel can be set up to study its ethics and merits. Many scientists and ethicists also say such a line should not be crossed without a wide-ranging public debate.

Erik Parens, an ethicist at the Hastings Center in Garrison, N.Y., says, "we've got to agree that that's . . . the road we want to go down. It's too important a road to go down inadvertently." [3]

ANDi and the New Jersey babies arrived on the heels of a string of other biotech firsts that may be propelling genetic research much faster down that road than the general public is prepared to go. In 1996, researchers at the Roslin Institute in Scotland cloned a sheep known as Dolly, and some scientists are now vowing to clone a human being in the near future.

More importantly, researchers recently completed sequencing, or mapping, the human genome, a development that promises to lead to a host of new therapies for inherited diseases. Having a map of the human genome is also a crucial step in enabling scientists to one day splice genes into an embryo to give the resulting child everything from greater disease resistance to blue eyes to enhanced musical ability.

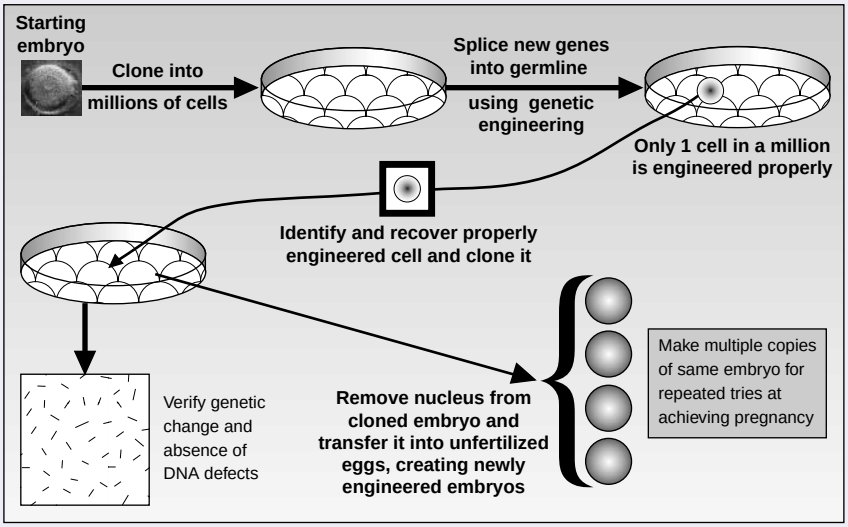
While most Americans support advances in biotechnology for medical purposes, the notion that the same research might lead to "designer babies" or human clones scares them. A recent *Time*/CNN poll found that 90 percent of Americans opposed human cloning and that 92 percent were against creating "genetically superior human beings." [4]

Indeed, on the day the complete genome map was announced, a *Time*/CNN poll indicated that nearly half of all Americans feared negative consequences from the work of the Human Genome Project. [5]

Some scientists and ethicists agree, saying such developments raise a host of potential problems and ethical issues. Allowing parents to "customize" their children would be tantamount to playing God and would demean the uniqueness of each individual, they argue. In addition, says Adam Wolfson, executive editor of *The Public Interest*,

## The ABCs of Human Genetic Engineering

*If scientists were to begin altering the human genome, a woman's egg would first be removed from her body and fertilized through in vitro fertilization, creating an embryo. The embryo is copied through cloning, and new genes are spliced into each embryo's germline — the genetic blueprint created from the genetic material contained in sperm and egg cells. Each cell in an organism resulting from the embryo will contain the new gene. Any physiological changes caused by the new gene, such as resistance to cancer or increased memory, could be passed on to future generations through normal reproduction.*




*Source: Prof. Lee Silver, Princeton University*

who has written on this issue, "this would turn children into mere consumer goods."

Critics also caution that no one really knows whether altering a person's genome would ultimately improve its life. "Would making someone smarter inevitably make them happy?" asks George Annas, a professor of health law at Boston University's School of Public Health.

But supporters of genetic enhancement say that critics make the same kinds of arguments each time a new technology is introduced. "They issue dire warnings every time something new comes along that could possibly make life better," says Gregory E. Pence, a professor of bioethics at the University of Alabama at Birmingham.

Pence feels confident that the new technology generally will be used wisely because parents, not bureaucrats or doctors, will control the changes being selected. "It's not scientists or some outside body but parents who will decide what traits are valuable," he says. "We can trust people to make the best decisions for themselves and their children, just like they do now."

Moreover, proponents contend, parents will not view genetically engineered offspring as consumer products but as children to be loved and nurtured. "Parents will still be parents, and they'll want to do everything they can to ensure that their children are happy," says Lee Silver, a professor of molecular biology and public affairs at Princeton University.

But critics also argue that genetic enhancement will almost certainly exacerbate class divisions between those who can and can't afford to genetically alter their children. "There is already a natural impulse to segregate ourselves," says Harry Yeide, a professor of religion at George Washington University. "This will accelerate that in a very dangerous direction."

But proponents counter that like all new technologies, genetic engineering eventually will become affordable. "This will quickly become available to a wide range of people," says Ronald Bailey, chief science correspondent for *Reason Magazine*.

In addition, he says, "enhanced" genes will be passed on to others naturally, through sexual reproduction.

According to most scientists, the technology for human gene manipulation is probably 10 to 20 years away. Still, many ethicists and scientists say that now is the time for a national debate on the issue. Currently, aside from a Food and Drug Administration ban on unsafe experiments on humans, there are no federal regulations governing the technology.

Human cloning represents a more immediate controversy, because it may be closer to reality. In 1997, former President Bill Clinton banned the use of federal funds in human cloning research. President Bush favors a total ban, a position supported by some in Congress.

As these new technologies move from the realm of science fiction to science fact, here are some of the questions being asked:

### *Should human genetic enhancement be banned on ethical grounds?*

In simpler times, a parent's job of molding and shaping a child came after

birth — with everything from teaching right from wrong to paying for clarinet lessons.

Today, however, science is increasingly an active partner in child rearing, often before the child is even born. Fetuses are routinely screened for potential genetic defects, such as Down's syndrome, spina bifida and Huntington's disease. Parents can even dramatically improve their chances of having a boy or a girl through a new, sperm-sorting process known as "Microsort." [6]

But in the not-too-distant future, scientists will be able to read a fetus' genetic code and possibly alter its genes to change such things as the child's body type, hair color, intelligence or even character before it is born.

Some researchers and ethicists say the ability to change human life at its most fundamental level will herald a new age of healthier, smarter and happier people. "I think it will ultimately free people from many of the limitations they would have had simply by accident of birth," Bailey says. "Everyone should be in favor of that."

But others say genetically engineering humans should be banned because it amounts to "playing God" without knowing the full extent of the long-term impact on society. "It is presumptuous for us to say that we are wise enough to know what an improvement of the human species is," says Leon Kass, a bioethics professor at the University of Chicago. "Would extending the lifespan to 150 or 200 or 300 years be good? Of course, we don't really know."

Even if children were to simply receive "better" human genes, such as enhancing a child's mental or physical abilities, it might have unforeseen developmental ramifications, critics contend. "It's naíve to think that you can go in there with the traits that deal with higher human powers, make some sort of change influencing, say, memory or lifespan, without [causing] real changes in other areas," Kass says. In other words, adding a new gene could have a profound ripple effect.

Many ethicists and theologians also worry that genetically engineering the human species may end up creating an unhappy society. "I really think that the dangers and risks here outweigh any benefits we might derive from it," says Boston University's Annas. "We all want our kids to be happy, but if we make them smarter, does that necessarily translate into more happiness? Children with Down's syndrome are happy, and many very smart people aren't."

Finally, Kass and other opponents say, genetically altering children will turn them into just another possession for their parents. "To really produce the optimum baby, you'd have to turn procreation into manufacturing, which would degrade parenthood," Kass says. "These people won't look upon their children as something they are duty-bound to nurture, but will see them as more like consumer products."

Proponents, however, argue that similar concerns are always voiced about life-enhancing procedures. "They said the same things about in vitro fertilization: that the babies would be regarded as products or commodities," Pence says. "They were wrong then, and they're wrong now." More than 100,000 healthy, loved American children have been conceived through in vitro, he points out.

Supporters also dismiss the idea that parents will see their genetically engineered children as consumer goods. "This is no different than giving your child advantages like piano lessons or private school," says Princeton's Silver. "Everyone wants their children to be successful and happy, and that's not going to change if we do this."

Parents won't make huge mistakes because they won't want to give their children unusual abilities, Silver says. "Parents will want to give their kids something other kids get naturally, because they won't want their children to be freaks."

Silver also disagrees with the claim that improving our genetic makeup would lead to negative physical or psychological ramifications. "There's simply no scientific basis for that," he says. "We evolved from apes — ultimately from bacteria — into something better. I don't see the downside of improvement so far."

Proponents contend that opponents have an almost irrational dislike of man-made changes. "They always say that it's against human nature or mother nature," Bailey says. "Well, what exactly does that mean?"

"A lot of these people think there's something sacred about natural changes," Silver adds. "Mother nature doesn't know what she's doing. That's why kids are born with terrible diseases."

### *Would genetically altering humans dramatically increase social tensions?*

Literature offers a number of cautionary tales about genetic engineering. The most famous, Aldous Huxley's haunting 1932 novel *Brave New World*, envisions a community where people are specifically bred to fulfill certain functions, from ruling alphas to drone-like gammas, who perform menial tasks.

Nancy Kress sketches a different genetic dystopia in *Beggars in Spain*, her recent novel about people bred to function without sleep. The "sleepless," as they are called, quickly prove to be smarter than everyone else, prompting a violent backlash from the sleepers and the segregation of genetically enhanced people from general society.

Many ethicists argue that such fictional scenarios are not so farfetched. Genetic engineering, they say, would not only deepen existing class divisions, but also create new ones. "We'd be adding biological disadvantages to the social and economic ones that we

already have to deal with," says Robert Wachbroct, a research scholar at the Institute for Philosophy and Public Policy at the University of Maryland at College Park.

"Certain people will quickly have a big leg up in the rat race, and everyone else will be forced to conform or drop out," says the University of Chicago's Kass. "Either you'll produce terrible class resentments, or you'll have to find a way to pacify those people who have been left behind."

Class resentment is likely to surface early, says George Washington University's Yeide, because genetically altered people will probably view themselves as superior to everyone else. "There are already organizations — like Mensa — that segregate the so-called superior people from the rest of us" with non-genius IQ's, he says. "The divide between the elite and the rest of us will grow wider."

Others say the divide eventually will be far more disturbing. "There will soon be two species of human beings," Kass predicts, adding that such a development is "incompatible with liberal democracy."

Having a second human species will create a host of new problems in society, he points out. "These people will either be seen as superior to us or as freaks," he says. "So either they will rule over us or we'll get scared and kill them."

But Bailey of *Reason* dismisses such scenarios. "This is likely to be a minor, transitory problem, if it is a problem at all," he says.

He and others contend that the technology will not give certain people advantages because it will not remain out of reach for long.

"Most of our socially important technologies, such as telephones, automobiles, television and computers, began as expensive toys for the rich and afterwards became cheap enough for ordinary people," said Nobel Prize-winning physicist Freeman Dyson. [7]

If anything, Bailey says, genetic enhancement will create a more egalitarian society. "As this technique becomes cheap and widely available, the current genetic gap will close, instead of widening," he says.

Most proponents, like the University of Alabama's Pence, disregard the "second species" fear as pure science fiction. Different species cannot crossbreed, they note, and the genes used in enhancement will not be artificial, but will consist of those already present in humanity's collective genome and not other species, as in ANDi's case.

Finally, supporters predict that people with enhanced genes will share their good genes with the general population through traditional means: sexual relations. "Genes move around the globe very rapidly today," Bailey says. "So the expensive upgrades that rich people give their kids will be passed on for free to a lot of others."

But critics counter that the technology and its benefits will probably remain out of reach for many. "Even if you made [enhancement] free, say by having the government pay for it, there would still be people who wouldn't want it, for religious or other reasons," Wachbroct says.

Moreover, argues science writer Robert Wright, government subsidies would create "a vast bioethical quagmire" that would probably cause more problems than it would solve. For instance, he writes, "there [are] things taxpayers aren't ready to pay for — such as genes of unproven benefit, say, or alterations whose downsides may exceed the upside." [8] ■

# BACKGROUND

## Mendel and Genetics

The science underlying today's genetics revolution is based on the work of Austrian monk Gregor Mendel. In 1866, Mendel laid out the basic laws of genetic inheritance after observing different varieties of peas in his monastery garden. He realized that inherited traits, such as seed color, came in pairs — one dominant and the other recessive. He eventually concluded that parents were three times more likely to pass on a dominant trait than a recessive one. [9]

Scientists soon realized that chromosomes and the genes within them were responsible for passing on hereditary traits. In addition, American geneticist Hermann Joe Muller discovered that genes could be changed to manifest new physical characteristics. The next big breakthrough came in 1953, when American researcher James Watson and his English colleague Francis Crick discovered the structural model for deoxyribonucleic acid (DNA), the chemical basis for heredity. Watson and Crick won the Nobel Prize for their discovery that every gene contains long chains of four simple molecules — adenine, cytosine, guanine and thymine — represented by the letters A, C, G and T. Each DNA chain contains thousands of these molecules laid out in a long double helix — a structure that looks like a twisted ladder — found in the chromosomes of each cell nucleus. [10] When taken together, the order of those thousands of molecules — like letters in a word — determines a person's genome. The genome specifies how the body makes proteins, the basic building blocks of life.

In 1990, the U.S. government began funding an effort to map the entire genome. Under Watson's leadership, the Human Genome Project hoped to have the entire genome sequenced by 2005. But in 1998, the effort got a huge shot in the arm when a private firm, Celera Genomics, entered the race. Competition from Celera, as well as new, faster gene-sequencing computers, sped up the process dramatically. [11] On June 26, 2000 — five years ahead of

schedule — scientists from the Genome Project and Celera announced that they had completed a preliminary sequencing of the human genome.

In mapping the genome, scientists discovered that there were fewer than 40,000 genes in a human cell, instead of the 100,000 that many had predicted. [12] In fact, scientists now say that only about 3 to 4 percent of a person's genes actually have a function. The remaining genetic material — known as junk DNA — has no known purpose. Armed with a genetic map, researchers turned to a new challenge: figuring out how to read and use the genome. "We have the book, and now we have to learn how to read it," Watson said. [13]

Learning how to "read" the genome is expected to take at least two to three years. It will almost certainly lead to a host of medical breakthroughs, but it also opens the door to the prospect of genetic manipulation and other non-therapeutic uses.

## Roots of Eugenics

The prospect of genetically altering human beings is often compared to eugenics — improving the human race through controlled scientific breeding.

But proponents of genetic manipulation say that unlike eugenics — in which a society acts (often coercively) to improve the population as a whole — genetically altered people would result from personal choice.

"A replay of state eugenic programs is the least likely way that this technology would be used," says Gregory Stock, director of the program on Medicine, Technology and Society at the University of California at Los Angeles (UCLA) School of Medicine. "It will be about people making choices — like parents making choices for their children — and the choices will be very diverse."

# Chronology

## 1860s-1940s

***New science of genetics gives rise to efforts at eugenics.***

***1866***
Gregor Mendel, an Austrian monk, publishes an article explaining the basic laws of genetic inheritance.

***1869***
Englishman Francis Galton makes the first modern argument in favor of eugenics policies.

***1927***
U.S. Supreme Court upholds forced-sterilization laws.

***1933***
Adolph Hitler comes to power in Germany and institutes a eugenics policy that ultimately leads to the death of millions.

## 1950s-Present

***Present Scientists unlock more secrets of genetics and begin to seek medical and other uses for genetic engineering.***

***Feb. 28, 1953***
Englishman Francis Crick and American James Watson discover the structure of deoxyribonucleic acid (DNA).

***1976***
Scientists produce the first transgenic mouse for use in medical research.

***1978***
An English woman uses *in vitro* fertilization to give birth to the first "test tube baby."

***1990***
Scientists at the National Institutes of Health first attempt human gene therapy in an effort to treat a young girl with a severely compromised immune system.

***1996***
Scientists in Scotland announce the birth of a lamb named Dolly, the first animal successfully cloned from an adult.

***June 26, 2000***
Scientists announce that they have completed a preliminary sequence of the human genome.

***Jan. 11, 2001***
Scientists in Oregon announce the birth of ANDi, the first genetically altered primate.

***Jan. 26, 2001***
American fertility expert Panos Zavos announces plans to attempt cloning a human being.

***March 28, 2001***
A House subcommittee holds a hearing on human cloning. Lawmakers vow to propose banning human cloning research in the United States.

***May 2001***
A New Jersey fertility doctor reveals in the British medical journal *Human Reproduction* that his pioneering infertility treatment has produced two babies with DNA from two different mothers, which he called "the first case of human germline genetic modification resulting in normal healthy children."

But some advocates of genetic manipulation echo themes that have been put forth by eugenicists. For instance, says Watson, genetics could be used to "cure what I feel is a very serious disease — that is stupidity." [14]

Such remarks have raised eyebrows, since similar sentiments also drove support for eugenics in Europe and the United States, often with horrific results. In particular, eugenics has been discredited because of its use by Nazi Germany to justify the extermination of millions during the Holocaust.

Eugenics in its most basic form predates genetic science by more than two millennia. In ancient Greece, thinkers questioned how heredity could be controlled to improve mankind. In his dialogue, *The Republic*, Plato spoke of selectively breeding "superior" people just as farmers matched animals to produce superior livestock. The Athenian philosopher also advocated eliminating the "feeble" in order to improve the quality of the republic's population.

The modern eugenics movement began in England in 1869. Sir Francis Galton, a cousin of Charles Darwin, argued that the English government should encourage superior persons with more "civic worth" than others — most of whom came from the upper classes like himself — to interbreed. [15]

Galton's ideas never took root in England, but they found more fertile soil in the United States in the early 20th century. The country was experiencing rapid population growth due to new immigration policies that, for the first time, allowed in non-Northern European whites in significant numbers. Newcomers from Eastern and Southern Europe were flooding into large cities, especially in the Northeast. Simultaneously, African-Americans were migrating from the South into the same Northern urban centers in search of good jobs.

The population shifts caused great anxiety among the established white population, most of whom were of Northern European decent. Many Americans — including famed pilot Charles Lindbergh — saw eugenics as a way to reverse the degradation of the quality of the nation's population.

Eugenics was behind the movement in education to test students' IQs and place them in classes with similar peers. [16] It also provided the intellectual justification for the 1924 Immigration and Restriction Act, which established strict immigration quotas based on race and ethnicity. Then-President Calvin Coolidge referred to the eugenic underpinnings of the new law when he said: "America must be kept American. Biological laws show that Nordics deteriorate when mixed with other races." [17]

America also embarked on a forced-sterilization program to prevent "defective people" from breeding. By the early 1930s, sterilization laws had been enacted in 27 states, and tens of thousands of Americans had been sterilized.

The U.S. Supreme Court upheld the sterilization laws, using eugenics to justify their decision. In a famous 1927 case, *Buck v. Bell*, no less than Justice Oliver Wendell Holmes applauded the forced sterilization of the [retarded] plaintiff, Carrie Buck, writing: "Three generations of imbeciles is enough." [18]

But eugenics reached its most twisted pinnacle in Germany after Adolph Hitler and the Nazis came to power in 1932. In trying to create an Aryan master race, Hitler initially killed or sterilized thousands of citizens who were disabled and otherwise deemed "feeble." He ultimately murdered millions of Jews, Slavs, Gypsies and other "undesirables" in death camps during the war.

After Germany's defeat, the horror of Hitler's eugenics program came to light, tarnishing the movement around the world. But some of the eugenicists' ideas continue to resonate. For instance, Charles Murray and Richard Herrnstein caused a sensation in 1994 when they proposed in their book *The Bell Curve* that standardized tests had shown innate differences in intelligence among different racial groups.

## Biotech Breakthroughs

Although some observers predict that the next hundred years will be known as the "biotech century," many biotech advances actually came about much earlier.

Cloning, for instance, did not start with Dolly the sheep in Scotland in 1996. In 1938, German scientist Hans Spemann had first proposed transferring the nucleus from the cell of an adult animal into an egg of another animal. The first cloning experiment took place in 1952, when scientists unsuccessfully tried to transfer the nucleus from a frog cell to another frog's egg. [19]

Ten years later, Oxford University zoologist John Gurdon successfully transferred the nucleus from frog cells to eggs with the nucleus removed. The resulting embryos developed into tadpoles that died before reaching adulthood.

Gurdon's success was followed in 1984 by the cloning of sheep. Soon, scientists had cloned a host of mammals, ranging from cattle to pigs. In all of these cases though, researchers planted the nuclei of embryonic cells — those taken from a fertilized embryo — into an egg. [20]

The next step was to figure out how to use adult cells for cloning. It was a challenge, since most of an adult cell's genes are "turned off," because a cell only uses those genes it needs to fulfill its function, such as carrying oxygen (blood cells) or transmitting electric impulses (nerve cells.) [21] Then Scottish scientists found a way to "turn on" all of the genes in an adult cell. As a result, they were able to suc-

# Using Animals for Research

Scientists have long used animals for medical research, and they continue to routinely test new drugs on animals before human trials begin. But in the near future, the role that animals play in both experimentation and treatment is likely to increase dramatically.

Mice, for example, have been genetically altered to contract cancer and other diseases. Scientists around the world use such "transgenic mice" — first created in 1976 — for medical research. Eventually, scientists hope to use genetic manipulation and cloning to create pigs and other animals that would produce drugs in their milk or even provide organs for humans.

While medicine may never embrace transplanting animal organs into humans — known as xenotransplantation — some animal tissues already have been used for therapeutic purposes. Sufferers of Parkinson's disease or paralysis from stroke, for example, have received cells from fetal pigs — with positive results in some cases. [1]

Biomedical-industry advocates say future developments in animal gene alteration will be invaluable in the quest for new medical treatments. But animal-rights advocates and ethicists say genetically altering animals is counterproductive and morally wrong. "This goes beyond the usual ethical concerns that are inherent in using animals for research, because now you're altering life at its most basic level," says Eric Kleiman, research director at In Defense of Animals, in Mill Valley, Calif.

By "altering life," animal rights advocates argue, scientists are creating new species without fully understanding how that may affect life in the future. For instance, a new species could carry a new disease that could wreak havoc with other animals and even humans. "These people keep saying, 'Just trust us' and 'Let us do what we like,'" Kleiman says. "But they really don't know — they can't know — what the fallout from their work will be."

"Animals harbor dozens of viruses, some of which might be benign in the host but are deadly to us," says Neal Barnard, president of the Physicians Committee for Responsible Medicine, which favors alternatives to animal experimentation. "Many people believe that HIV [originally] passed from monkeys to humans, and we could soon find ourselves facing something as bad or far worse if we start putting animal organs into people."

Finally, Barnard and others say, the research causes tremendous pain and suffering to the animals. "We've learned in the past 20 to 30 years that animals are not blocks of wood, but have complex emotional and social lives," he says. "To experiment on them terrifies and traumatizes them and is a kind of cruelty you can't defend."

But supporters of animal-based research contend that the potential benefits justify animal experimentation. "Isn't it cruel to have insect exterminators at your home?" asks Frankie Trull, president of the National Association of Biomedical Research. "But we do it because we see it as a tradeoff that's worth it." By the same token, it might be cruel to give an Alzheimer's gene to a mouse, "but if doing so alleviates the suffering of millions, isn't it worth it?"

Jacquie Calnan, president of the Americans for Medical Progress Educational Foundation, says xenotransplantation must be explored for the good of mankind. "If humans were meeting our organ needs, then no one would even be talking about using animals as a source of organs," she says. "But right now, we're meeting only 10 percent of our organ needs, which makes us ethically bound to find out if it will work or not."

Finally, supporters say, lab animals are not mistreated and are used for medical research only when necessary. "Science uses the tools most appropriate to the task," Trull says. "So animals would be [genetically altered] only when they were needed, because scientists are not a bunch of Frankensteins."

[1] "The New Animal Farm: Can Pigs Produce Organs for Humans," *Newsweek*, April 2, 2001.

cessfully clone an adult sheep. Since Dolly's birth, scientists have cloned other types of mammals using adult cells, including cows, pigs and mice, fueling speculation that a human clone may be just years away.

Although genetic manipulation has a much shorter pedigree than cloning, it also is not a recent phenomenon. Scientists produced the first genetically engineered, or transgenic, mouse in 1976. Researchers alter mice primarily to give them certain diseases, so they will make more effective laboratory test subjects.

These mice have been modified in the germline stage: that is, genes have been transplanted into a sperm, egg or embryo. The changes become a permanent part of the creature's genome and can often be passed on to their offspring. [22]

Genetic manipulation of humans, on the other hand, has involved only somatic cells — those that have been removed from the patient, altered and put back. While the somatic cells may have new genes, the rest of the person's cells have not been altered, so the changes cannot be passed on to offspring.

The first genetic experiments on humans began in 1990, when scientists at the National Institutes of Health (NIH) used so-called gene therapy to treat a young girl with severe compromised immuno-deficiency disease (SCID). Known as the "bubble boy" disease, SCID forces sufferers to live in germ-free environments because their immune systems don't function due to an enzyme deficiency.

The NIH team removed white blood cells from the patient and inserted the gene that produces the missing enzyme. The cells were then rein-

serted into the child's body. While the experiment was hailed as a success, many critics claimed that the young girl was already taking a drug that mitigated her condition. [23]

Scientists have since identified genes that cause a variety of human ailments, including sickle-cell anemia and cystic fibrosis. The recently announced sequencing of the entire genome is already leading to the discovery of many more genetic links to disease.

But efforts to treat these conditions with gene therapy have met with little success. Scientists have found it hard to ensure that new genes will work once they are placed in human cells. Still, researchers believe that new technology and a better understanding of how genes work in a cell eventually will make genetic therapy a major medical tool. ■

# CURRENT SITUATION

## Action in Congress

On Jan. 26, Panos Zavos, a professor of reproductive physiology at the University of Kentucky, announced that he and an Italian fertility specialist hoped to clone a human being in the next year or two at a facility on a Mediterranean island. [24] Around the same time, Bridget Boisselier, a fertility expert who works for a religious group known as the Raelians, claimed to have 50 women willing to carry a clone to term and vowed to soon begin her work at a secret laboratory in the United States.

The two announcements prompted a hearing before the House Energy and Commerce Subcommittee on Oversight and Investigations on March 28. Lawmakers seemed particularly troubled by the prospect that inevitably unsuccessful cloning attempts would produce profoundly deformed babies. Efforts at cloning animals less sophisticated than a human typically succeed only 1 to 5 percent of the time. Cloned animals that have survived have had various physical problems, including defective kidneys and compromised immune systems. Even Dolly has suffered from unexplained obesity.

"It is my view that the risk is so grave —and it appears to be that grave for the foreseeable future, for decades — that we will have to act," said Chairman James Greenwood, R-Pa.

He and other panel members plan to introduce legislation banning human cloning research, a position supported by the White House. "The president believes that no research — no research — to create a human being should take place in the United States," Ari Fleisher, President Bush's press secretary, said after the hearing. [25]

Currently, human cloning is not banned in the United States. Since former President Clinton only prohibited the use of federal funds for human cloning research, scientists may still use private money to conduct cloning experiments.

Some ethicists say Zavos and Boisselier are unlikely to make a serious attempt at human cloning any time soon. "I've heard these declarations before, and I think they're just trying to get attention by shocking us," says the University of Maryland's Wachbroct. "They know that if they tried the procedure using human cells, the overwhelming odds are that they would fail."

"The experience with animal cloning allows us to predict with a high degree of confidence that few cloned humans will survive to birth, and that of those, the majority will be abnormal," agrees Rudolph Jaenishch, a professor of biology at the Massachusetts Institute of Technology.

Still, an attempt to clone a human being in the near future seems inevitable. "I think they'll go ahead and try it," says UCLA's Stock. "I think it will be much, much harder than they imagine."

But Zavos believes potential problems should not deter scientists interested in cloning. "Tell me any invention that didn't have its failures at first," he said. [26]

Moreover, he said, his efforts would only be used to help infertile couples. Similarly, Boisselier of the Raelians wants to help parents devastated by the loss of a child by cloning their dead son or daughter.

"We're curing something of a problem, rather than just letting someone duplicate their ego," Zavos said. "We're not interested in cloning Michael Jordan." ■

# OUTLOOK

## Sense of Inevitability

History has often portrayed science as an inevitable march toward some great goal — like splitting the atom or developing a polio vaccine. As a result, many people believe that with enough time and determination, there is no problem scientists cannot solve.

The idea that man is the ultimate maker of his own destiny was perhaps best summed up recently by futurist Kevin Kelly, who said: "We are as Gods; so we might as well get good at it." [27]

In biotechnology, the sense of inevitability is particularly strong, and for good reason. Given the rapid series of biotech accomplishments in the last five years alone, many predict that genetic enhancement is just around the

*Continued on p. 436*

# *Should the federal government ban human cloning research?*

**SHARON TERRY**
*VICE PRESIDENT, GENETIC ALLIANCE, WASHINGTON, D.C.*

**FROM TESTIMONY BEFORE HOUSE ENERGY SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS, MARCH 28, 2001**

The Genetic Alliance, the largest coalition of genetics consumer and professional organizations worldwide, calls for an immediate halt to all efforts to clone human beings and recommends open and informed societal dialogue on this crucial issue.

Based on recent scientific reports about the current status of mammalian cloning, we know that there are tremendous potential human safety risks for mother and child. The track record for mammalian cloning indicates that these medical risks are formidable and extreme, even dire. The fact is that current cloning techniques to produce a genetically identical human being do not come close to meeting the rigors or minimum human protection, safety, efficacy and medical standards.

Moreover, societal dialogue is urgently needed to identify and understand the social, legal and ethical risks posed by the application of this technology. Rapidly emerging scientific research and technologies — such as human cloning — force us to examine the very essence of what it means to be human. The immensity of these issues demands that we halt all current efforts to clone human beings and engage all stakeholders in open and informed debate about the implications and impact of this technology.

At every step in advancing technology, we must ask ourselves whether we are propelled by justifiable societal needs or simply by new biomedical opportunities. As a society, we must discuss and debate the full range of ethical, legal and social issues surrounding the cloning of human beings. It is critical that this broad-based dialogue engages families and communities within the context of culture and faith.

Central to this dialogue is consideration of the role and responsibility of society in preventing harm to individuals and families. Debate about the cloning of human beings highlights a fundamental necessity that all research and clinical projects, regardless of funding source, come under the spotlight of human subjects' regulatory protections. This is the only way to ensure, in a landscape of escalating biomedical technologies, the well being and safety of families and communities.

In addition, protections must extend beyond current levels to encompass all research and clinical projects, regardless of whether the funding comes from the government or private sector. The discovery of a new technology should not automatically translate into availability of that technology without regard for public safety and well-being.

**GREGORY E. PENCE**
*PROFESSOR OF BIOETHICS, SCHOOL OF MEDICINE AND HUMANITIES, UNIVERSITY OF ALABAMA AT BIRMINGHAM*

**FROM TESTIMONY BEFORE HOUSE ENERGY SUBCOMMITTEE ON OVERSIGHT AND INVESTIGATIONS, MARCH 28, 2001**

In the early 1970s, all bioethicists except Joseph Fletcher opposed "test-tube babies" for fear of monsters, harm to families and harm to the identity of the children created. Many of these same critics today oppose human cloning.

Now more than 100,000 American babies exist — 200,000 worldwide — who would not have existed had these critics won. Back then, over 80 percent of Americans opposed test-tube babies; now the same percentage of Americans support such efforts.

What can we learn from this experience? First, such babies were not viewed by their parents as the critics predicted; that is, as "commodities" or as "products." Instead, and because of the effort and cost that the parents endure, these children are very, very loved.

To me, the essential moral question is whether human cloning is intrinsically wrong. But how can a new way of creating a family be intrinsically wrong? How can a way of avoiding hereditary genetic disease be intrinsically wrong?

If it is not intrinsically wrong, then we must ask whether it is wrong for some other associated reason, mainly whether a child created by cloning would be harmed, psychologically or physically.

I believe that how children are originated has little to do with their future mental health. The real requirement for happiness of children is loving parents.

As for physical danger, I believe that children should not be originated by cloning until this process is as safe as sexual reproduction, which now has a roughly 1-2 percent rate of abnormalities. At the moment, I believe it is premature to proceed with attempts to originate humans by cloning, but continuing research and advanced screening techniques for embryos may one day achieve safe results. Until then, I believe that families and physicians should be allowed to handle such matters without being subject to criminal penalties.

Over 20 years ago and partly in response to worries about assisted reproduction, Congress banned federal funds from being used for embryonic research. Over subsequent decades, many scientists tried to get this ban overturned, but it was very difficult to do so. If cloning were similarly banned or criminalized, it would be very difficult to ever undo such prohibitions — no matter what science later learned. Let us learn from the past and not repeat its mistakes.

*Continued from p. 434*

corner. "This really isn't a question of whether, but when," Princeton University's Silver says. "Scientifically, we'll be able to make this work within 10 years."

*Reason* magazine's Bailey agrees. "We're not very good at inserting genes into embryos right now, and so we're going to have to improve that technology," he says. "It may be another 10 or 15 years before we're ready, but things are moving so fast. Who knows? It all may come sooner."

But some experts disagree. "This is going to be extraordinarily difficult, probably 100 times more difficult than human cloning, which is also going to be very difficult," says Boston University's Annas. "The problem here is that different genes react differently with each other, so that when you add new ones, you don't know what you're going to get."

The University of Chicago's Kass agrees that using genetics to dramatically alter someone, especially intellectually, will be extremely difficult. "The [proponents of genetic enhancement] exercise a kind of extreme reductionism when they think that something like intelligence can be traced to one gene or even a constellation of genes," he says. "You'd have to know so much about the relation of the part to the whole that I'm skeptical that, on scientific grounds, you're going to be able to do a great deal to affect intelligence or character."

But optimists counter that the recent discovery that humans have far fewer genes than originally thought, and that most of those genes serve no known purpose, makes the prospect of genetic manipulation much more real. "We've discovered that things are much less complicated than we originally thought," Wachbroct says.

Indeed, Silver says, the only thing that might delay genetic enhancement is government regulation. "The only real obstacle to this will be a political one," he says. "People are afraid of change, and they may try to stop this."

But UCLA's Stock disagrees, arguing that genetic enhancement will arise from research by respectable scientists. "The government won't be an obstacle to this because it will come from mainstream scientists doing mainstream research," he says.

Indeed, Stock says the first efforts at genetic manipulation will likely be spun off from medical research. "The foundations for this will arise from gene therapy, infertility research and the Human Genome Project," he says.

Bailey agrees, adding that the first uses for actual genetic manipulation also will be therapeutic. "We'll start all of this by using it to repair genetic defects," he says.

Still, many observers say, once genetic manipulation becomes acceptable for medical purposes, enhancement won't be far behind. "The first changes will be physical changes, like trying to protect kids against cancer, AIDS, Alzheimer's and other diseases," Silver says. "Eventually though, we'll start changing our intelligence and character. ■

## Notes

[1] Jason A. Barritt, *et. al.*, "Mitochondria in human offspring derived from ooplasmic transplantation: Brief communication," *Human Reproduction*, 2001, Vol. 16, pp. 513-516.

[2] Quoted in Jane Lampman, "Doctors cross line that modifies future generations," *The Christian Science Monitor*, May 10, 2001.

[3] As quoted on National Public Radio's "Morning Edition," May 9, 2001.

[4] Cited in Nancy Gibbs, "Baby, It's You, and You, and You . . ." *Time*, Feb. 19, 2001.

[5] Rick Weiss and Justin Gillis, "Teams Finish Mapping Human Genome," *The Washington Post*, June 27, 2000.

[6] "America's Next Ethical War," *The Economist*, April 14, 2001.

[7] Quoted in Dinesh D'Souza, "Staying Human: The Danger of Techno-Utopia," *National Review*, Jan. 22, 2001.

[8] Robert Wight, "Who Gets the Good Genes?" *Time*, Jan. 11, 1999.

[9] David Masci, "The Cloning Controversy," *The CQ Researcher*, May 9, 1997, pp. 409-432.

[10] *Ibid.*

[11] Mary H. Cooper, "Human Genome Research," *The CQ Researcher*, May 12, 2000, pp. 401-424.

[12] Figures cited in Scott Estham, "To Be Human," *The San Francisco Chronicle*, March 25, 2001.

[13] Weiss and Gillis, *op. cit.*

[14] Quoted in D'Souza, *op. cit.*

[15] Leslie Jones, "Social Darwinism Revisited," *History Today*, August 1998.

[16] Stephen Jay Gould, *The Mismeasure of Man* (1981), pp. 174-183.

[17] Alan Stoskepf, "The Forgotten History of Eugenics," *Rethinking Schools*, spring, 1999.

[18] Roger Shattuck, *Forbidden Knowledge* (1996), p. 196.

[19] Masci, *op. cit.*

[20] *Ibid.*

[21] Masci, *op. cit.*

[22] Jeremy Rifkin, *The Biotech Century* (1998), p. 27.

[23] Craig Donegan, "Gene Therapy's Future," *The CQ Researcher*, Dec. 8, 1995, pp. 1089-1112.

[24] Rick Weiss, "U.S. Fertility Expert Announces Effort to Clone a Human," *The Washington Post*, Jan. 27, 2001.

[25] Quoted in Rick Weiss, "Scientists Testify on Human Cloning Plans," *The Washington Post*, March 29, 2001.

[26] Quoted in Weiss, *op. cit.*

[27] Quoted in D'Souza, *op. cit.*


## About the Author

**David Masci** specializes in science, religion and foreign-policy issues. Before joining *The CQ Researcher* as a staff writer in 1996, he worked as a reporter at Congressional Quarterly's *Daily Monitor* and *CQ Weekly*. He holds a law degree from The George Washington University and a B.A. in medieval history from Syracuse University.

# Bibliography

## Selected Sources Used

### Books


**Ridley, Matt, *Genome: The Autobiography of a Species in 23 Chapters,* HarperCollins, 1999.**

Ridley, a science writer, uses one gene from each of the 23 human chromosomes to tell the story of genetics and the potential impact of gene research on our knowledge of human psychology.

**Rifkin, Jeremy, *The Biotech Century: Harnessing the Gene and Remaking the World*, Tarcher/Putnam, 1998.**

Rifkin, president of the Foundation on Economic Trends, argues that the dangers of altering the human genome far outweigh any benefits to humanity.

**Silver, Lee M., *Remaking Eden: How Genetic Engineering and Cloning Will Transform the American Family*, Avon, 1998.**

Silver, a professor of molecular biology and public affairs at Princeton, argues cautiously in favor of human genetic manipulation.


### Articles


**Bailey, Ronald, "Petri Dish Politics," *Reason*, December 1999.**

Bailey, science correspondent for the libertarian magazine Reason, dismisses arguments against genetic manipulation, claiming that opponents are simply clinging to what they know instead of being open to developments that could substantially improve human life.

**Cooper, Mary H., "Human Genome Research," *The CQ Researcher*, May 12, 2000.**

An invaluable guide through the issues associated with the Human Genome Project. Particularly helpful are the sections on the history of the project and the potential uses of the information it will garner.

**Kass, Leon, "The Wisdom of Repugnance," *The New Republic*, June 2, 1997.**

A professor of bioethics at the University of Chicago argues that allowing biotechnology to fundamentally alter reproduction will lead to a debasement of what it means to be human.

**Lemonick, Michael D., "Designer Babies," *Time*, Jan. 11, 1999.**

Lemonick explores the scientific and ethical questions surrounding the genetic manipulation of human beings.

**Talbot, Margaret, "A Desire to Duplicate," *The New York Times Magazine*, Feb. 4, 2001.**

A good overview of the people and organizations trying to clone human beings and the issues associated with their efforts.


### Reports and Studies


**National Bioethics Advisory Commission, "Cloning Human Beings," June 1997.**

The commission examines the implications of cloning technology for potential efforts to clone humans.


## FOR MORE INFORMATION

**Center for Biomedical Ethics**, 701A Welch St., Suite 1105, Palo Alto, Calif. 94304; (650) 723-5760; scbe.stanford.edu. The Stanford University facility studies a broad range of biomedical issues.

**Council for Responsible Genetics**, 5 Upland Road, Suite 3, Cambridge, Mass. 02140; (617) 868-0870; www.gene-watch.org. Supports more stringent government regulation of genetic research.

**Genetic Alliance**, 4301 Connecticut Ave., N.W., Suite 404, Washington, D.C. 20008; (202) 966-5557; www.geneticalliance.org. An international coalition representing more than 300 consumer and health organizations that supports people with genetic conditions.

**In Defense of Animals**, 131 Camino Alto, Suite E, Mill Valley, Calif. 94941; (415) 388-9641; www.idausa.org. Opposes using animals for medical research.

**National Association for Biomedical Research**, 818 Connecticut Ave., N.W., Suite 303, Washington D.C. 20006; (202) 857-0540; www.nabr.org. Supports the humane use of animals for biomedical research.

**Physicians Committee for Responsible Medicine**, 5100 Wisconsin Ave., N.W., Suite 404, Washington D.C. 20016; (202) 686-2210; www.pcrm.org. Proposes alternatives to using animals for medical research and opposes altering animals for xenotransplantation.

# The Next Step

## *ANDi*

**Abate, Tom, "First Gene-Altered Monkey Hailed as Research Tool/Opponents Concerned About Ethical Issues," *The San Francisco Chronicle*, Jan. 12, 2001., p. A1.**

Researchers in Oregon have produced the world's first genetically altered primate by inserting a jellyfish gene into the embryo of a rhesus monkey.

**Sternberg, Steve, "Monkey Glows Green, For Human Benefit; Gene Technique Goal: Introduce, Then Study, Cancer and Other Ills," *USA Today*, p.A1.**

Scientists have created the world's first mutant monkey, a baby rhesus that most likely will become the first in a long line of genetically engineered primates.

**Weiss, Rick, "Scientists Create First Genetically Altered Monkey," *The Washington Post*, Jan. 12, 2001, p. A1.**

The creation of ANDi, a backward acronym for "inserted DNA," marks the first time anyone has genetically altered a primate.

**Will, George F., "The Monkey That Could Mean the End," *The Washington Post*, Jan. 21, 2001, p. B7.**

There are some things humanity cannot get used to without jeopardizing its humanness — without becoming beastly. Creeping toward us, as on little cat feet — little monkey feet, actually — is perhaps the gravest imaginable crisis, one that could result in the end of history as a distinctively human, and humane, story.

## *Cloning*

**Bailey, Ronald, "Twin Freaks, Should Human Cloning be Banned? Maybe," *Reason Online*, Feb. 7, 2001.**

One of the sad points that The New York Times Magazine article, "Lab of the Human Clones," makes is that a lot people apparently have a deep misconception that cloning can bring back or replace a dead child.

**Friend, Tim, "Human Cloning Project May Have Begun," *USA Today*, March 29, 2001, p. D8.**

A private research firm has begun cloning a human using the DNA of a dead infant. An embryo is expected to be implanted into a surrogate mother within two weeks, said Brigitte Boisselier of CLONAID, a Quebec company.

**Murray, Thomas H., "Even If It Worked, Cloning Wouldn't Bring Her Back," *The Washington Post*, April 8, 2001, p. B1.**

Two experts on animal cloning reported that the cattle, mice and other mammals cloned thus far have suffered staggering rates of abnormalities and death; some of the females bearing them have been injured and some have died.

**Ryan, Joan, "Cloning Denies Our Uniqueness," *The San Francisco Chronicle*, March 30, 2001, p. A25.**

Last Sunday, my son asked why he had to go to church when he was having a perfectly good time watching "Scooby Doo." The main reason, I told him, was to understand that God went to the trouble of creating him as a person unlike anyone else who ever lived.

**Zitner, Aaron, "Reprogramming of Genes at Core of Cloning Debate; Science: Egg cell spurs fetal development but it can err. Zavos' claims on finding flaws questioned," *Los Angeles Times*, April 22, 2001, p. A31.**

Panayiotis Zavos' dispute with the country's top cloning experts centers on the seemingly magical powers of the egg cell. Cloning takes advantage of the fact that almost every cell in an animal contains all the genes needed to grow and operate that animal all over again.

**Zitner, Aaron, "Lawmakers Propose Human Cloning Ban, Alien Order Notwithstanding; Congress: Before law is urged, House panel hears from unorthodox group that plan replication," *Los Angeles Times*, March 29, 2001, p. A22.**

The white-suited leader of a Canadian religious group told lawmakers that they should no more block his plans to clone human beings than they would stop the development of antibiotics and other medical advances.

## *'Designer' Babies*

**Crenson, Matt, "Genetic Manufacturing of Babies Raises Variety of Ethical Questions; Science: Potential for good — eradicating disease, delaying death — is countered by fears about loss of individuality, parenting, equality and the notion of fate," *Los Angeles Times*, April 9, 2000, p. A11.**

Science is on the brink of giving us the power to redesign ourselves. But behind that promise lurks a long, cold shadow of doubt.

**Deneen, Sally, "A Genetic Glimpse: Ordering Designer Children Like Pairs of Shoes," *Chicago Tribune*, March 11, 2001, p. C1.**

Princeton University microbiologist Lee Silver can see a day a few centuries from now when there are two species of humans — the standard-issue "Naturals" and the "Gene-enriched," an elite class whose parents bought for them designer genes.

**Haney, Daniel Q., "Science Aims for Designer Babies; Humanity: Researchers say parents soon will be able to pick their children's genes. The process, called germ-line engineering, is showing promise in lab animals. But critics warn of unintended consequences.," *Los Angeles Times*, April 9, 2000, p. A12.**

Suppose parents-to-be could guarantee their children will grow up to be unusually healthy. Or extra smart. Or maybe just a little better looking than mom and dad.

## *Eugenics*

**Kimmelman, Michael, "Beauty" Brains? Place Your Orders," *New York Times*, Feb. 16, 2001, p. A33.**

"I wouldn't be surprised if in another 30 years," said Francis S. Collins, director of the National Human Genome Research Institute, "that some people will begin to argue, as Stephen Hawking already is, that we ought to take charge of our own evolution . . . and try to improve ourselves."

**Timberg, Craig, "Va. House Voices Regret For Eugenics; State Was Once a Leader In Forced Sterilizations," *The Washington Post*, Feb. 3, 2001, p. A1.**

The House of Delegates voted today to express regret for Virginia's forced sterilization of 8,000 mostly poor, uneducated men and women for supposed hereditary "defects."

## *Gene Therapy*

**Chea, Terence, "Gene Therapy's Host Seat; Ignoring Skeptics, GenVec Forges Ahead With Drug Development," *The Washington Post*, Feb. 20, 2001, p. E1.**

The death of an Arizona teenager during an experiment 17 months ago intensified public scrutiny of gene therapy.

**Cimons, Marlene, "U.S. Announces Safety Rules for Gene Therapy Tests; Routine reporting on patient oversight will be required. Move comes in wake of evidence that monitoring 'has been less than adequate,' FDA says," *Los Angeles Times*, March 8, 2000, p. A16.**

The two federal agencies that oversee gene therapy experiments announced that researchers will be required to routinely submit plans for monitoring patient safety.

**Manier, Jeremy, "Gene Therapy Shows Promise for Parkinson's Cases," *Chicago Tribune*, Oct. 27, 2000, p. N4.**

Chicago researchers recently injected five rhesus monkeys with a virus containing a gene that they hoped would slow the progression of a brain ailment resembling Parkinson's disease. Within months, the experiment had exceeded the investigators' expectations.

**Maugh II, Thomas H., "Gene Therapy May Have Cured 3 Infants," *Los Angeles Times*, April 28, 2000, p. A1.**

French gene researchers have successfully treated three infants with severe immunodeficiency disease.

**"Panel Urges Follow-Up to Gene Threapy," *Los Angeles Times*, April 7, 2001, p. A11.**

Participants in some gene-therapy trials should be closely followed for up to 20 years after a study's completion to guard against future complications, a U.S. advisory group said.

**Torassa, Ulysses, "Gene Therapy Could Help Hemophiliacs; Experiment shows promising results for producing protein for clotting," *The San Francisco Chronicle*, Dec. 5, 2000, p. A13.**

Researchers reported positive results yesterday from an attempt to fix the genetic defect that causes spontaneous bleeding in people with hemophilia.

**Weiss, Rick, "Gene Research Rule Proposed; Regulation Seeks to Increase U.S. Review, Keep Reporting Manageable," *The Washington Post*, Dec. 13, 2000, p. A2.**

The Clinton administration yesterday proposed a new system for tracking dangerous side effects of experimental gene treatments.

# Back Issues

**The CQ Researcher *offers in-depth coverage of many key areas.***
***Back issues are $10 for subscribers, $20 for non-subscribers.***
***Quantity discounts available. Call (800) 638-1710 to order back issues.***

***Or call for a free CQ Researcher Web trial!***
***On-line access provides:***

- *Searchable archives dating back to 1991.*
- *Wider access through IP authentication.*
- *PDF files for downloading and printing.*
- *Availability 48 hours before print version.*

**CHILDREN/YOUTH**
Rethinking Ritalin, October 1999
Child Poverty, April 2000
Fatherhood Movement, June 2000

**CRIMINAL JUSTICE**
Policing the Police, March 2000
Drug-Policy Debate, July 2000
Community Prosecution, December 2000

**EDUCATION**
The Digital Divide, January 2000
Zero Tolerance, March 2000
Community Colleges, April 2000
Cheating in Schools, September 2000
Testing in Schools, April 2001

**ENVIRONMENT**
Energy and the Environment, March 2000
Zoos in the 21st Century, April 2000
Mass Extinction, September 2000
Water Quality, November 2000

**HEALTH CARE AND MEDICINE**
Diet and Health, February 2001
Diabetes Epidemic, February 2001
Cell Phone Safety, March 2001
Biotech Foods, March 2001

**LEGAL ISSUES**
Closing In on Tobacco, November 1999
High-Impact Litigation, February 2000
Gay-Rights Update, April 2000
Faith-Based Initiatives, May 2001

**MODERN CULTURE**
Islamic Fundamentalism, March 2000
Future of Computers, May 2000
Future of Books, June 2000
Future of Language, November 2000
Sportsmanship, March 2001

**POLITICS/GOVERNMENT**
Utility Deregulation, January 2000
Campaign Finance Reform, March 2000
Immigration Reform, July 2000
Missile Defense, September 2000
The Federal Reserve, September 2000
Democracy in Latin America, Nov. 2000
Redistricting, February 2001

**TRANSPORTATION**
Traffic Congestion, August 1999
Airline Industry Problems, September 1999
Auto Industry's Future, January 2000

## Future Topics

- ***Energy Policy***
- ***Libraries and the Internet***
- ***Nuclear Waste Disposal***