

Nitzotzot Min HaNer

CLONING

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The editorial board of Nitzotzot Min HaNer thought that it would be timely to provide an issue on cloning. For a Jewish perspective, see The Journal of Halacha and Contemporary Society, number xxxiv (Fall, 1997) Cloning People and Jewish Law: A Preliminary Analysis, by Rabbi Michael J. Broyde. The article also appears at Jlaw.com (Click on articles and then scroll down to Medicine/Health. See there by the same name).

We have yet to hear the opinion of the major poskim on this issue and it is certainly premature to say what the Jewish position is. In his article, Rabbi Broyde concludes: "In sum, I am essentially unaware, at this point in my investigation, of any substantive violation of Jewish law that definitionally occurs when one clones cells from one human being into the egg of another and implants that fertilized egg into a gestational mother. Thus in those circumstances where the clonor is a man such that he fulfills the obligation to be fruitful and multiply or its rabbinic cognate and he cannot fulfill the obligation otherwise (including through AID/H or IVF), cloning can be classified as a good deed (mitzvah kiyumi); in those circumstances where the clonor is a woman, cloning can be classified as religiously neutral, neither prohibited nor a mitzvah, simply permissible, depending on the desires of the parties." Rabbi Broyde himself makes several qualifications to this statement and he does stress that his article is only a preliminary analysis. Rabbi Lau recently came out with a statement condemning cloning. The purpose of our article is not to deal with the Jewish approach. Rather, it is to give a clear picture of what has happened in the history of cloning and what the rest of the world is saying about this right now.

CLONING

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CLONING

Last week, the leader of a religious sect claimed that the first human clone has been born -- a 7-pound baby girl dubbed "Eve." Eve was purportedly created using DNA from the mother's skin cells and is a genetic twin of her mother, a 31-year-old American citizen¹.

A second cloned baby is due to be born next week to a lesbian couple in northern Europe, and four others are due by early February.

The announcement was met with skepticism and concern, since other cloned mammals have had serious birth defects or developed health problems later.

Former French journalist Claude Vorilhon, called the development "just the first step" toward human immortality through cloning. Vorilhon, who now calls himself Rael, claims to be a direct descendant of extraterrestrials who created human life on Earth through genetic engineering.

The Raelians eventually hope to develop adult clones into which humans could transfer their brains, Rael said. This, they feel, would give humanity eternal life through cloning. The chemist for the Raelian, Dr. Brigitte Boisselier, claims that cloning is a basic human right. "It is our own choice to use our genes the way we want," she said.

A group of independent scientists has been chosen by freelance journalist and physicist Dr. Michael Guillen to verify that Eve is the first human clone.

¹ The Food and Drug Administration had previously received a written agreement from Rael's chief scientist, Dr. Boisselier, not to pursue human clones in this country. But she said the cloning would continue in another country, which she would not name.

Zavos, a former University of Kentucky professor, also has announced plans to clone a human but has yet to successfully create an embryo. Italian doctor Severino Antinori has said several times in recent months that there is a woman carrying a human clone, which would be born in January.

The three cloning proponents said they would screen embryos for genetic abnormalities; but animal cloning experts countered that there was no way to test a cloned embryo in advance to predict whether it will result in a healthy birth.

"I think, frankly, that we are dealing with a group here that was trying to beat the competition," University of Pennsylvania bioethicist Glenn McGee said. "There is a pretty good-sized group of not-so-credible scientists trying to make Mini-Me, and one said he would make a clone by mid-January. Clonaid (Rael's company) had one last shot, and they tried to take it."

WHAT IS CLONING?

In cloning, scientists mechanically replace the nucleus of an egg with DNA from another cell. The reconstructed egg is then treated to make it divide and grow into an embryo. The resulting embryo has 100% of the genes from one person, instead of a mix from two people.

In the case of Dolly, the first cloned sheep, Wilmut and his team had transferred the nucleus from the cell of an adult ewe to a donor egg whose own nucleus had been removed, leaving only the outer membranes and the cytoplasm. To fuse the adult nucleus and the hollowed egg together and to activate development of the embryo the researchers applied an electrical pulse, essentially shocking it to life. The hard part -- that had been thought impossible before Dolly -- was to show that the DNA in the adult nucleus, which was already serving its mature, specialized purpose, could essentially be tricked into dividing and otherwise behaving like a brand-new fertilized egg. The next, not particularly complicated step, was to implant the embryo in the uterus of yet another sheep, which served as a surrogate mother. (It could have been implanted in the adult ewe who contributed the nucleus, but in this case, that ewe was by then dead.) Since the nucleus of each cell in the body contains the genetic instructions for the whole, the resulting offspring, Dolly, was one that shared an identical genotype with the original -- a clone. Human cloning would work essentially the same way.

The next step is to tinker with the embryo's DNA before putting it in the womb. By knocking out a gene called "alpha 1-3 gal transerase," for example, scientists could prevent a cloned pig from making a substance that normally lines its blood vessels—a sugar that human immune cells attack. Genes added to the mix could render the organ more humanlike.

HISTORY

Cloning adult animal cells was thought impossible until very recently. The first cloning was achieved in February 1997 when Scottish scientists cloned two sheep -- Meg and Dolly -- from a mature adult². This was not the first cloning -- but previously, sheep had been cloned from the cells of embryos.

² Ian Wilmut and his colleagues at the Roslin Institute in Scotland announced that they had successfully used a technique called somatic cell nuclear transfer to create a cloned sheep they named Dolly.

Conventional wisdom says that successful cloning requires fresh cells. But scientists at the University of Connecticut have come up with a way to clone animals from cells that have been grown in the lab for months. In addition, the use of cultured cells would allow scientists to tinker with the cells' genes before cloning a new animal.

In 1998 Advanced Cell announced that one of its researchers had produced a hybrid human-cow embryo. Jose Cibelli had, two years before, taken some of his own cells and fused each with a cow egg. He grew one such early embryo through five cell divisions in a lab dish, but halted the experiment to assess its ethics. Noah is the first such hybrid to develop past a ball of cells in the lab and into a fetus with all the right organs, limbs-even eyelashes and hooves.

Piglets were the fourth type of mammal to be successfully cloned. The pig turns out to be an almost perfect organ donor for humans. Not only are its organs nearly identical in size and function, but the risk of pig-to-human disease transmission is much lower than it would be with closer relatives, such as monkeys or apes. But because the body reacts violently to foreign objects, organs transplanted from normal pigs are viciously attacked, turn black, and can die in the space of hours.

In 2000, scientists took the cloning idea even further. They cloned a gaur (Noah), an ox-like creature, the first endangered animal ever cloned and had it carried by a different beast altogether: an ordinary dairy cow³.

In Spain, attempts are now being made to clone the bucardo, a mountain goat that became extinct when a tree fell on "Celia," the last of its kind. The tissue was frozen; if it can be cloned in the egg of a common ibex, the bucardo would live again⁴.

In the past four years, scientists have cloned more sheep, as well as goats, cows, pigs and in the most efficient cloning experiment yet, dozens of mice over six generations from a single mouse. The goal of most cloning projects is to create herds of genetically identical animals that could produce drugs in their milk or replacement organs for humans. Each of these breakthroughs makes human cloning that much more technically feasible.

This year scientists created a cloned cat⁵ and they're hard at work on cloning dogs⁶. Two companies offer DNA banking for pets to be cloned⁷. Hundreds of people have already signed up. One of these companies planned to start cloning cats for a few clients late in 2002. The prospect of cloning a pet -- what might be called the first instance of sentimental cloning -- makes it, for some people, all that much more emotionally feasible.

³Lanza and colleagues first collected skin cells from a gaur soon after it had died. Then they retrieved oocytes (eggs) from cows killed in an abattoir. Using a needle, they removed each egg's nucleus, which contains cow genes. They injected a gaur cell, complete with its own DNA containing nucleus, beneath the oocyte's outer envelope. A pulse of electricity made the egg fuse with the gaur cell. The egg grew and divided, forming a ball of cells. The scientists shipped batches of such cells to Iowa, where they were implanted into surrogate mother cows.

Already Noah is a survivor. Out of 692 fused cells, 81 grew and divided into balls of at least 100 cells. Of those, 44 were transferred into 32 surrogate mothers. (Lanza had another batch waiting to go to Iowa, but the overnight-delivery service didn't show.) After miscarriages and mishaps, only Noah remains.

⁴ Culled from Sharon Begley Newsweek, October 16, 2000, Cloning the Endangered:

⁵ Named CC.

⁶ Researchers working on the Missyplicity Project at Texas A&M are using the \$2.3 million offered them by a bereft pet owner to try to copy his dead dog, Missy.

⁷ The cost: Around \$1,000 for processing and \$100 a year for storage. The current going rate for cloned cows is about \$20,000.

HUMAN CLONING - HISTORY

The immediate response to Dolly's birth was a revulsion against the idea of using the same technique to clone human beings and nineteen countries immediately banned the practice, though not the USA.

However, most scientists believe that the discussion of whether humans will be cloned has moved from the question of if to the question of when⁸. A team of Korean scientists claimed to have successfully cloned human cells, but stopped the experiment before the cells had matured enough to be sure.

As far back as 17th June 1999, details of the first human embryo to be cloned were released. The cloning was achieved the previous November, using a cell from a man's leg and a cow's egg. The scientists who created it⁹ let the clone develop for twelve days before incinerating it. Dr Robert Lanza, ACT's director of tissue engineering, stated that the embryo cannot be seen as a person before 14 days. Moreover, he stated that the purpose was 'therapeutic' rather than 'reproductive' cloning. The idea was to produce and cultivate stem cells, with a view to growing transplantable limbs and organs, nerve-cells, hormones and suitably modified marrow-cells. Lord Robert Winston, the British fertility expert, said the research was 'totally ethical'.

Then on October 13, 2001, an American Company, ACT, announced that they had created cloned human embryos.

Advanced Cell Technology was not trying to clone a human being. Rather, it wanted to offer a method that would involve combining human eggs and a person's own cells to create embryos that would provide stem cells. Theoretically, the stem cells could in turn grow into virtually any cell type and serve as replacement tissue in diseases like diabetes.

Such therapeutic cloning would have the advantage that the replacement tissue would be an exact genetic match, so patients would not have to take anti-rejection drugs. But the idea has raised ethical concerns because it would require destroying a cloned embryo to extract its stem cells.

Therapeutic cloning—which seeks, for example, to use the genetic material from patients' own cells to generate pancreatic islets to treat diabetes or nerve cells to repair damaged spinal cords—is distinct from reproductive cloning, which aims to implant a cloned embryo into a woman's uterus leading to the birth of a cloned baby. Many scientists who oppose reproductive cloning because of the potential risks to both mother and fetus, nevertheless support therapeutic cloning.

Therapeutic cloning may help people with diabetes, autoimmune disorders, and diseases involving the blood and bone marrow. By deriving nerve cells from cloned embryos, scientists hope not only to heal damaged spinal cords but to treat brain disorders such as Parkinson's disease.

The cloning attempt announced in November, 2001, began with a series of unsuccessful attempts beginning July of the previous year. In the end, it took a total of 71 eggs from seven volunteers. Even then, of the eight eggs that were injected with cumulus

⁸ At first it was thought that cloning a human was a long way off. Despite concerted effort, no one has yet succeeded in cloning a monkey. However, it may be, that from a logistical point of view, it's actually *more* difficult to clone monkeys than humans. Don Wolf of the Oregon Regional Primate Research Center says, "We don't have 750 labs across the country doing assisted reproduction in monkeys. Some of the clinical work we've been struggling with -- how best to grow monkey embryos, how to transfer them directly to the uterus -- are old hat in the I.V.F. world."

⁹ Working for American Cell Technology

cells, only two divided to form early embryos of four cells—and one progressed to just six cells—before growth stopped.

In the attempt, the embryos died before they had even eight cells, and most died long before that. Cloning experts outside the company said the experiment was a failure. The intended purpose was to coax the early embryos to divide into hollow spheres of 100 or so cells called blastocysts. And then to isolate human stem cells from the blastocysts to serve as the starter stock for growing replacement nerve, muscle and other tissues that might one day be used to treat patients with a variety of diseases.

Only one of the embryos progressed to the six-cell stage, at which point it stopped dividing. In a similar experiment, however, the same group of scientists succeeded in prompting human eggs—on their own, with no sperm to fertilize them—to develop into blastocysts.

For any cloning procedure, women willing to contribute eggs to be used in the cloning procedure have to be recruited. The women are given hormone injections for several days so that they would ovulate 10 or so eggs at once instead of the normal one or two.

Scientists are now attempting to induce human eggs to divide into early embryos without being fertilized by a sperm cell. This has already been done with animals. Because egg cells still retain a full set of genes. Stem cells derived from such parthenogenetically activated cells would be unlikely to be rejected after transplantation because they would be very similar to a patient's own cells and would not produce many molecules that would be unfamiliar to the person's immune system. Such cells might also raise fewer moral dilemmas for some people than would stem cells derived from cloned early embryos.

While cloning for human reproduction is now banned in Japan and in most of Europe, there are countries where assisted reproductive technology has become increasingly sophisticated and where no legislation forbids cloning. South Korean researchers, for example, have been active in animal cloning, and a few years ago, a team at Kyunghee University Hospital in Seoul claimed to have created an embryo from the nucleus of a 30-year-old woman, then destroyed it after developing it to the four-cell stage in vitro. (The researchers never published their results, however, casting doubt on the project.) "I wouldn't be surprised if you heard of it happening in some province of India or Pakistan that wanted to show it had a place in the world," said Gregory Pence. China is another possibility, especially since its I.V.F. industry has lately taken off and its one-child policy has encouraged eugenic thinking.

Three years ago, a 10-month-old baby boy died in the hospital after a minor operation went wrong. The baby's parents, an American couple, had two other children and probably could have had another if they wished; neither parent was infertile, and both were healthy and in their 30's. But they did not want another child. They wanted this child. And before long, they began to believe that the longing they felt was telling them something quite specific -- that their dead baby's genes were crying out, as a ghost might, to express themselves again in this world. The idea preoccupied them that their little son's genotype deserved another chance, that it had disappeared by mistake and could be brought back by intention.

The grieving couple then approached the Raëlians, announcing that they would be willing to fund them in an all-out effort to clone the boy from cells they had frozen after surgery performed two weeks before his death.

Cloning mammals is a wildly inefficient process that can require hundreds of attempts both to create an embryo and to implant it successfully. Only two or three out of every hundred attempts to clone an animal typically result in a live offspring. But for that very reason, successful cloning is partly a numbers game, in which luck and the ready availability of many donor eggs and borrowed wombs can play as significant a role as technical expertise. "When you look at what would be critically required to clone a human being, surrogates and

a large number of eggs are key ingredients, and the Raélians have those," said Gregory Stock, the director of the Program on Medicine, Technology and Society at U.C.L.A.'s School of Medicine. "They certainly have what's necessary to make a solid attempt. Besides", said Stock, "what they're doing is of symbolic significance. If they don't succeed, someone else will in the next five years."

Over time the initial revulsion at the very notion of cloning -- what bioethicists call the "yuck factor" -- has dwindled as more mammals have been cloned and as the prospect of someday replicating household pets seems to render the whole concept somehow cuter and more benign. Legislative efforts to ban cloning for reproductive purposes have stalled -- only four states (California, Rhode Island, Louisiana and Michigan) have passed laws against it -- and the federal moratorium merely precludes government money from going to it. Meanwhile, bioethicists, the professionals who promise to guide us through these troubled waters, have by and large embraced cloning, convinced that access to it constitutes a "reproductive right," a natural extension of technologies intended to help the infertile. Indeed, the people who openly express a desire to clone these days tend not to be megalomaniacs. Rather, they are infertile couples who want a biologically related child and have exhausted other means, or bereaved parents yearning to "replace" a child they've lost.

Moreover, it is not unprecedented for fringe groups to serve as incubators for concepts that would not be acceptable in mainstream science. The Raélians are not a tiny group -- they claim 55,000 members worldwide. Since 1974, they have raised \$7 million toward the construction of an "embassy" where alien visitors could be welcomed to our planet in style. Their followers, who hold fast to the ideal of everlasting life created through technology, are a devoted lot, claiming to find emotional and religious meaning in science and biotechnology¹⁰.

The Raélians have a knack for drawing in pleasant, attractive, professionally successful people in scientific or technical fields -- computer analysts, robotics engineers, lab technicians. Raelians claim to have lined up surrogates to carry the cloned embryo. If one pregnancy failed, another surrogate would automatically step into line; there would be no need to wait another month, as you would have to if you were dependent on the cycles of just one woman. The main problem is the transfer of the DNA and making sure there are no defects when that transfer occurs." Still, the Raélians had decided to use surrogates rather than encouraging the dead baby's mother to carry the child, because they didn't want her to have to go through a miscarriage "and lose that baby all over again."

The bereaved parents are inclined to say that their lost child should be around us laughing and so on. He deserves to live again. And through cloning, there is a way for this genetic code to express itself so he can laugh and play and become whoever he was meant to become. They know the baby will not be exactly the same as the first one. But they are still working to get him back. They think this baby should be alive.

Clonaid has a list of a hundred people who have expressed interest in its services, most of them would-be parents with severe infertility problems, a handful of them homosexual couples. "In some cases," Clonaid chief scientist, Boisselier, conceded, "they could go to a sperm bank and so on, but they felt better about having a child with their own genes. I think it's probably written in us to have a succession of our genes." But lately, she was getting calls mainly from the parents of children who have died -- infants, teenagers, young adults -- though few of the callers had the foresight, or whatever one would call it, to freeze the tissue that would make cloning the dead even theoretically possible.

¹⁰ Raël, a French-born former race-car driver who is the movement's leader, says that in 1973, he had the first of several encounters with aliens from which he heard the message that humans had been created in a laboratory by advanced beings from another planet who had mastered genetics and cell biology.

They will tell you that they realize cloning does not produce a copy of the original person, but something more like a later-born identical twin, and yet say that they would want to do it anyway. They'd want to do it so that they could know as much as possible in advance about their unborn children, so they wouldn't have to take their chances on sexual reproduction, so they could perpetuate their own genes or so they could hope against hope to get back somebody very, very much like somebody they had lost.

Of course, if a dead child could be cloned, the result would be a baby -- and then a child and then an adult -- created to fulfill inescapably precise and poignant expectations. It's hard to imagine a human being who would be less of an end in himself.

Commenting on the resistance to cloning, Raël said: "It was the same when Louise Brown, the first test-tube baby, was born. It was all Frankenstein and monsters. And now you have hundreds of test-tube babies made every day, and nobody asks anything about it because they know it's not bad. And that's why I am hoping that Clonaid will be the first company to make a cloned baby. And then everyone will see on CNN, maybe 'Larry King Live,' a beautiful family, a smiling baby, and we know it will be smiling because it will be a copy of the one we know, and people will say, 'Ah, that's beautiful!' and public opinion will change. It was the same at the beginning of fire, and with the steam engine and electricity. All human progress."

In some ways, Raël is merely the surreal version of other more respectable biotech utopians -- academics like Gregory Stock of U.C.L.A., who claim that new reproductive technologies are the beginning of the end of sex as the way we reproduce. "We will still have sex for pleasure, but we will almost certainly see our children as too important to leave to a random meeting of sperm and egg." Or Lee Silver, a molecular biologist at Princeton, who sanguinely predicted that parents will one day be able to choose for their children genes that increase athletic ability, genes that increase musical talents and ultimately, genes that affect cognitive abilities. "Why shouldn't parents be able to give their child something that other children already have?" (Like Raël, few of the mainstream biotech utopians seem overly concerned about the willful creation of genetic haves and have-nots.) Or brainy business guys like the former Microsoft executive Nathan Myhrvold, who has said that resistance to cloning is "just another form of racism," a kind of "discrimination against people based on a genetic trait -- the fact that somebody has an identical DNA sequence."

The very fact that at this moment, the research is proceeding underground, unaccountable, poses a real threat of babies born deformed, and of renegades dictating the moral position on this issue by saying, in effect, "It's right because we did it."

Yet, despite the dangers, enough people will continue to support the effort. The urge for immortality is too powerful. As one man put it: "I can thumb my nose at Mr. Death and say, 'You might get me, but you're not going to get all of me,'" he says. "The special formula that is me will live on into another lifetime. It's a partial triumph over death. I would leave my imprint not in sand but in cement."

MORAL ISSUES

Questions:

Can one clone a baby? If so, under what circumstances may one or ought one to do so?

Cloning may be used for the following purposes:

To help an infertile couple to reproduce

To allow an unmarried woman or lesbian couple to reproduce

For purposes of medical research

For purposes of producing replacement body parts

For purposes of replacing, to some degree, a dying or dead person.

For purposes of greater control over the reproductive process. For example, in the case of a father with a genetic disease, cloning would allow the child to avoid inheriting those genes. Do any of these allow for cloning?

What is the status of the cloned person? Is she the daughter of the person from whom she is cloned¹¹, or her sister¹²? Does she have any relationship with the mother's husband. Is he considered her father?

May a cloned fetus be placed in another woman's womb? If this is done, what is the relationship of this second woman to the clone¹³? Is it possible for both the woman who has been cloned as well as the woman who bears the child (the gestational mother) to be considered the child's mother¹⁴? Could the gestational mother be considered the only mother? If this is the case when a normal egg cell is planted in her ovum, does the fact that the genetic mother contributed 100% of the genetic material make any difference?

Cloning could also involve two women, one who donated the nuclear DNA and the other mitochondrial DNA. What is the relationship of the child to each woman in such a case?

It is also possible also to clone a male. Would he be the halachik father of the child¹⁵? Would the child have any mother? If not, is the Yichus of the child (Jewish or non-Jewish) determined by the father? Can a male fulfill the Mitzvah of Pru U'Revu through cloning¹⁶? Rabbi Michael Broyde¹⁷ points out that it is much easier for a male to be considered the

¹¹ "If the genetic donor is a woman, perhaps one could claim that the gene donor is also the mother in accordance with the logic of Rabbi Bleich found below, or in accordance with those authorities who label the egg donor the mother according to Jewish law in cases of surrogacy." - Rabbi Michael J. Broyde, in his article in the Journal of Halacha and Contemporary Society

¹² Rabbi Broyde (ibid.) rejects the suggestion that cloned and clonee be considered siblings rather than mother and daughter. "The splitting of a fertilized egg is perhaps the simplest form of cloning, the argument goes, and just like that case produces sibling relationships and not a child-parent relationship, so too, a clone from an adult should be classified as siblings, and not as a child. I believe this analysis is incorrect. What makes the identical twins siblings in the case of fertilized eggs, is the definition of siblings discussed above: a common mother and father. The fact that these children share a uterus and a common egg, and thus a mother (see Yevamot 97b cited above) inclines one to think that they also share a father who provided the sperm that immediately created the first one of them, and thus they are siblings. Clonor and clonees do not share a mother (egg donor or gene provider) or a father (provider of genetic material) and thus are not siblings."

¹³ Rabbi Michael J. Broyde, in his article in the Journal of Halacha and Contemporary Society suggests that she would indeed be the mother.

¹⁴ Rabbi J. David Bleich, "In Vitro Fertilization: Questions of Maternal Identity and Conversion" Tradition 25:4 summer 1991 82-102, at pages 86-88 writes that Rabbi Shlomo Zalman Auerbach held that a child can, halachikally, have two mothers.

¹⁵ Yes says Rabbi Michael J. Broyde, in his article in the Journal of Halacha and Contemporary Society, number xxxiv (fall, 1997) Cloning People and Jewish Law: A Preliminary Analysis

¹⁶ Rabbi Broyde (ibid.) is of the opinion that he would fulfill the mitzvah or at least the Mitzvah of LaSheves Yatza

¹⁷ The Journal of Halacha and Contemporary Society, number xxxiv (fall, 1997) Cloning People and Jewish Law: A Preliminary Analysis

father than for a female to be considered the mother. For in the case of the female, where she did not carry the child herself, there is a competing claim by the surrogate or gestational mother.

Cloning can take place from someone who is already dead. Can a dead person then be considered to have given birth to a child?

If cloning is permissible, does the person being cloned need to give their permission?

If some of these purposes are good and some are bad, should cloning be banned because of the slippery slope down which it may slide? As Rabbi Michael J. Broyde put it, cloning is a procedure "whose consequences we do not fully understand, and whose results we cannot predict."

What are the implications of cloning for married life and for alternative life-styles, and how does this impact on the halacha?

If cells are cloned, may one destroy them before 14 days (which is the current scientific practice)¹⁸?

If it is forbidden to destroy cloned cells, what should be done with them? Can they be frozen or must the scientists implant them in a womb to produce a baby? Who owns the cells?

If cloning is forbidden, what kind of transgression has been committed by the various parties (the mother, the scientist who did the cloning, the women who had the clone implanted, if this was done)?

What kind of transgression is it to kill cloned cells before 14 days after their conception?

Scientists unqualified to decide:

While there were those, like the sociobiologist Richard Dawkins, who wrote that "it would be mind-bogglingly fascinating" to watch "a younger edition of myself growing up in the 21st century," or the freewheeling physicist Richard Seed, who claimed he couldn't "wait to clone himself three or four times," most people are disturbed by the idea of making genetic copies.

Since clones have already been created at a cellular level, many scientists feel that the only ethical question is apparently not whether cells should be cloned, but whether we should allow or encourage to bring such clones to term. If they are not allowed to go to term, this would involve creating and incinerating human or chimeric embryos. And if they are, then we will have decided that cloning is right because the technology has dictated to us that it can be done.

"By default, society has assigned the physician the role of theologian and moralist - a role for which he has no competence. The fear of sickness and death, aided by the intentionally cultivated aura of mystery and the deep respect of the laity for scientific achievement, has resulted in this unwritten election of the medical community as arbiter of the most fundamental truths of Torah morality and of Western Civilization." (Rabbi Dr. Moses Tendler in *Challenge*)

¹⁸ Rabbi Broyde considers but rejects the possibility that a cloned person would have the status of a Golem. It is permissible to destroy a Golem.

"Science tells us how to heal and how to kill; it reduces the death rate in retail and then kills us wholesale in war; but *only wisdom...can tell us when to heal and when to kill.*" (Will Durant, *A History of Philosophy*)

"A doctor is as qualified to pass judgment on when life begins and ends as a chef is on which foods are carcinogenic or a computer programmer about which way the PC market is about to go. All are likely to sound intelligent; none have more than an educated layman's chance of being right." (Durham/Chapel Hill Federation Newspaper, 1994)

"Thinking rigorously ethically is a highly specialized business. The (great rabbi) ... is aware that what he thinks about the centrality of the family, the value and the purpose of life, the right to self-determination and G-d are not only going to influence his answers, they will determine the very questions that get asked. And those questions will already point us toward a particular answer. As the Sages put it, 'The question of a wise man is half the answer.'" (ibid.)

Already, bioethicists who favor cloning have begun outlining the categories of people who might consider it. Indeed, for the last several years, those in the profession who have taken up the subject of human cloning seem to have been more concerned with identifying its worthwhile applications than with raising serious alarms about it. "Bioethicists are the most enabling community of all," said George Annas, a professor of health law at Boston University and one of the few bioethicists who has called for a ban on human reproductive cloning. "There's a libertarian strain among bioethicists -- autonomy and individual rights are so important to them that it's virtually impossible for them to look beyond that." Indeed, bioethicists often resort to a sort of consumer logic: there's a market out there that wants this, and who am I to say they can't have it?

"The short answer to the cloning question," says ethicist Caplan, "is that anybody who clones somebody today should be arrested. It would be barbaric human experimentation. It would be killing fetuses and embryos for no purpose, none, except for curiosity. But if you can't agree that that's wrong to do, and if the media can't agree to condemn rather than gawk, that's a condemnation of us all."

BENEFITS

Children for the Infertile:

Rebecca, a thirtysomething San Francisco Bay Area resident, spent seven years trying to conceive a child with her husband. Having "been to hell and back" with IVF treatment, Rebecca is now as thoroughly committed to cloning as she is to Christianity. "It's in the Bible--be fruitful and multiply," she says. "People say, 'You're playing God.' But we're not. We're using the raw materials the good Lord gave us. What does the doctor do when the heart has stopped? They have to do direct massage of the heart. You could say the doctor is playing God. But we save a life. With human cloning, we're not so much saving a life as creating a new being by manipulation of the raw materials, DNA, the blueprint for life. You're simply using it in a more creative manner."

"I could imagine three main groups who'd be interested in cloning," said Ronald Green, a professor of ethics at Dartmouth (and an adviser to the biotech company Advanced Cell Technologies). The first would be couples in which the woman lacks viable eggs and the man lacks viable sperm, "and cloning is the only way they can have a child who is biologically related to them." The second "would be lesbian parents -- and, to a lesser extent, gay men, since they'd still need a female surrogate." Unlike sperm donation, cloning would allow such a couple to sidestep "a genetic third party who, years down the line, might want to gain access to the child." The third group, said Green, would be made up of "people with

serious genetic disorders that are not amenable to other modes of prevention like genetic screening -- because maybe the specific mutation isn't known or many different genes are involved -- and who still want to have their own biological child." Gregory Pence envisions an even larger market that would include people disappointed with the current array of assisted-reproduction technologies (which, after all, only succeed 25 percent of the time); heterosexuals wary of using the eggs or sperm of a stranger; and people "too sophisticated" to take a chance on the "lottery" of sexual reproduction with their husbands or wives. A button given to me by one of the Raëlians puts it succinctly: "Cloning -- Reproduction Without Compromise."

Therapeutic Benefits:

The real future benefits of cloning might come not from creating copies of a human but copies of human cells, making it possible to, say, grow new retinal tissue after the current tissue has given out. Since they come from your own body, cloned cells don't face the problems of rejection that other transplants do, meaning that they could prove invaluable in treating and even curing disease.

Many who have pondered the question have considered the issue in terms whether the benefits of cloning outweigh the dangers. This presumes that the values involved are quantifiable, and that we can violate one sense of values if we believe we have accumulated sufficient benefits to outweigh.

Cloning proponents like to attach themselves to the whole arena of stem-cell research, the brave new world of inquiry into how the wonderfully pliable cells of seven-day-old embryos behave. Embryonic stem cells eventually turn into every kind of tissue, including brain, muscle, nerve and blood. If scientists could harness their powers, these cells could serve as the body's self-repair kit, providing cures for Parkinson's, diabetes, Alzheimer's and paralysis. Actors Christopher Reeve, paralyzed by a fall from a horse, and Michael J. Fox, who suffers from Parkinson's, are among those who have pushed Congress to overturn the government's restrictions on federal funding of embryonic-stem-cell research. So far, the main source of embryonic stem cells is "leftover" embryos from IVF clinics; cloning embryos could provide an almost unlimited source.

However, the question is whether cloning is necessary at all to achieve even what its proponents have in mind. A number of startling advances are emerging that may offer alternatives to the technique.

Until now, the only known way to provide new body cells containing a patient's own DNA has been to create an early-stage cloned embryo to produce the versatile stem cells that can then be prodded to become any type of body tissue. But because embryo research is such an explosive issue, progress has been stymied and lawmakers have threatened to ban the work.

Researchers at Advanced Cell Technology, the biotech firm that created a six-cell cloned human embryo, describe success in creating replacement body cells for primates by tricking an egg to start dividing without being fertilized. The proliferating cells are bryonic, but they are incapable of creating a living organism, rendering the technique less objectionable to many¹⁹.

DANGERS

¹⁹ U.S. News and World Report, February 11, 2002

Myriads of Unanswered Questions:

If a woman cloned herself and reared the child, she would be her own daughter's identical twin. If she had a husband, he would eventually find himself with a daughter who uncannily resembled his wife. Would this lead to confusion, even incest? And how could a cloned child live out his life freely, knowing he was the recipient of a preworn, consciously selected genotype? Wouldn't it be horrifying to know so much from such an early age about your own fate -- what diseases you'd be likely to get, what personality flaws? What sort of narcissism would cloning unleash in us? What new enticement would it offer to tinker with our genes and produce "superior" babies by design? Would cloning, with its seeming guarantees, gain an edge on sexual reproduction, with all of its unknowns? Would babies no longer be conceived but manufactured? What would it say about us if we wanted that?

A world in which cloning is commonplace confounds every human relationship, often in ways most potential clients haven't considered. For instance, if a woman gives birth to her own clone, is the child her daughter or her sister? Or, says bioethicist Leon Kass, "let's say the child grows up to be the spitting image of its mother. What impact will that have on the relationship between the father and his child if that child looks exactly like the woman he fell in love with? Or", he continues, "let's say the parents have a cloned son and then get divorced. How will the mother feel about seeing a copy of the person she hates most in the world every day? Everyone thinks about cloning from the point of view of the parents. No one looks at it from the point of view of the clone."

If infertile couples avoid the complications of choosing which of them to clone and instead look elsewhere for their DNA, what sorts of values govern that choice? Do they pick an uncle because he's musical, a willing neighbor because she's brilliant? Through that door lies the whole unsettling debate about designer babies, fueled already by the commercial sperm banks that promise genius DNA to prospective parents. Sperm banks give you a shot at passing along certain traits; cloning all but assures it.

Just as women have long been able to have children without a male sexual partner, through artificial insemination, men could potentially become dads alone: replace the DNA from a donor egg with one's own and then recruit a surrogate mother to carry the child. Some gay-rights advocates even argue that should sexual preference prove to have a biological basis, and should genetic screening lead to terminations of gay embryos, homosexuals would have an obligation to produce gay children through cloning.

All sorts of people might be attracted to the idea of the ultimate experiment in single parenthood. Jack Barker, a marketing specialist for a corporate-relocation company in Minneapolis, is 36 and happily unmarried. "I've come to the conclusion that I don't need a partner but can still have a child," he says. "And a clone would be the perfect child to have because I know exactly what I'm getting."

Cloning advocates view the possibilities as a kind of liberation from travails assumed to be part of life: the danger that your baby will be born with a disease that will kill him or her, the risk that you may one day need a replacement organ and die waiting for it, the helplessness you feel when confronted with unbearable loss.

Dehumanizing:

Leon Kass wrote in *The New Republic* in 1997: Human cloning is dehumanizing: it turns natural procreation into manufacturing and children into commodities. The clone is pre-planned, made-to-order, and so its makers—not just a parent-donor but the whole technological team involved in the process—have it at their mercy. "Cloning is inherently

despotic,” says Kass, “for it seeks to make one’s children (or someone else’s children) after one’s own image (or an image of one’s choosing) and their future according to one’s will.”

And what kind of lives can cloned children expect to have? Kass says, "It's not just that parents will have particular hopes for these children. They will have expectations based on a life that has already been lived. What a thing to do--to carry on the life of a person who has died."

As we have written at the end of the next section on murder, many biologists have been moving in a direction away from the distinctions between man and the animals. This is a sinister development, making it easier for scientists to justify the kind of insensitivities which Kass is referring to.

Murder:

As we stated above, clones have already been created at a cellular level, and are then destroyed after a few days. Many scientists feel that the only ethical question is apparently not whether cells should be cloned, but whether we should allow or encourage to bring such clones to term. If they are not allowed to go to term, this would involve creating and incinerating human embryos. And if they are, then we will have decided that cloning is right because the technology has dictated to us that it can be done.

In considering this question, many scientists seem to be only concerned with what can suffer, or have its dignity infringed. A pre-implantation embryo probably has no feelings, and certainly has no sense of its own self-worth or social standing. Therefore, since no-one is hurt, they argue no wrong is done.

These scientists agree that, if allowed to continue, these clones will become people. If so, the fact that it doesn't know it's been injured is besides the point. The clone already has the status of a human being and no-one is entitled to destroy it. This is, of course, no different to the abortion debate as to when life begins.

Currently, scientists accept a 14-day cut-off point until which they can destroy the zygote. After that, they would have to take the positive and controversial step of implanting the embryo in someone's womb if they meant to keep it alive. It may be that some people will interpret the 14-day limit as a judgement on the moral standing of the embryo, as though it suffered some substantial change at 14 days. But this time is actually purely arbitrary.

Some commentators²⁰ will ask whether a tissue culture also counts as an entity to be respected. Certainly, such a culture should not be treated as mere 'stuff'. But it is nothing more, they say, than an isolated growth.

Consider further: if we do succeed in growing particular organs from such cloned cells, will they be merely 'separate parts' or will they be badly mutilated persons, human creatures reared in conditions that make them vulnerable to socio-medical predation? This too is a metaphysical issue. It certainly cannot be decided by logic alone. But to what higher source does science propose to appeal to find out the answer.

The truth is, that even a dead body should be treated with respect (as should any human tissue or organ: could there be innocent lampshades made of human skin, or goblets made from a human skull?). Maybe the insertion of a human nucleus into an emptied bovine ovum, or even an emptied human ovum, is no injury: it is still an offence. Respect for

²⁰ Other moments that have been variously suggested for suddenly granting the entity some legal protection have been 'the formation of the primitive streak', 'quickenings', 'becoming capable of extra-uterine survival', 'birth', 'paternal acknowledgement', 'first words', 'the moment when the child first walks away'. None of these seem to be particularly compelling. Fertilization (though this too is a process with several stages) is the moment when it is most plausible to suppose that the particular entity begins.

humanity demands that we not treat creatures as if they were mere material, even if the victims aren't conscious of the offence, and even if they wouldn't mind if they were.

Humanity must always be treated as an end – never as a means. No human being — not even a dead or irrecoverably comatose human being — is to be used merely as a resource or tool. One should not even injure oneself — which is why, traditionally, one cannot properly consent to being mutilated, branded, drugged or killed. We can't license others to do any of those things to us, and may sometimes ourselves be punished for doing them to ourselves.

All the above issues are based on the idea that humans are in a special category and cannot be compared with animals. However, biologists do not necessarily feel that way. People who feel queasy about mixing human and non-human genes (or, as in this case, human and non-human cells) are typically reminded that there are no essentially human genes. The human genome is made up from exactly the same bases and codons as any other genome, even if those codons spell out a somewhat different set of instructions. The thousand-or-so distinguishable genes that 'probably make the difference' between human and chimpanzee aren't alien intrusions, but just more of the same bases, in slightly different orders. Nor are there any essential properties that all and only human beings possess in virtue of their humanity. Species have turned out to be sets of interbreeding populations, more or less isolated at a particular time from other such sets. The argument for genetic engineering is that we are simply exploring, just a little more quickly, the range of possibilities that natural evolution also explores.

Defects:

A significant number of problems are still being reported amongst cloned animals. Dolly has arthritis at a young age, and cloned mice seem to have a shortened life span. Nearly all of the animal cloning efforts have led to high rates of fetal and neonatal mortality in the resulting offspring. Those who compare cloning to current I.V.F. techniques -- arguing that lots of those fail, too -- neglect to mention that I.V.F. failures consist mostly of unsuccessful implantations, not the sudden deaths of young babies.

"All sorts of things go wrong," said George Seidel, a cloning researcher at Colorado State University. Cloned cattle and sheep are often born dangerously large. "Normally you might expect a 100-pound birthweight in a calf, but with a clone, you might get 160 pounds," said Seidel. Because such outsize calves don't have room to wriggle around in the uterus, they can be born lame or with limb deformities. "Sometimes the kidneys aren't right, they're just plain put together wrong -- or the heart is, or the lungs, or the immune system," he added. "It can be a unique abnormality in each case. They can die within a few days after birth, or sometimes they just can't make it after you cut the umbilical cord." Nobody really knows why.

"We're talking about an abnormality rate of maybe 30 percent in cloned animals," said Siedel. "In human babies, the normal rate of congenital defects is about 2 percent, and we wouldn't tolerate a jump to 3 percent."

Besides, though cloned animals can be normal and healthy-appearing -- some cloned mice and cattle even seem "improved," in the sense that they appear to age more slowly -- what's normal in a barnyard animal isn't all that high a standard. "The fact that you can get a sheep or a mouse that looks normal," said Stuart Newman, a developmental biologist at New York Medical College, "doesn't mean that some subtle things haven't gone wrong in brain development that you wouldn't necessarily notice in a sheep, but you would in a human. Yes, you can clone a mouse -- but can you take him to the opera?" Cloned humans might show

higher rates of cancer or other diseases, but we'd only find out by cloning them and waiting to see if disaster strikes.

It reportedly took 104 attempts before the first IVF baby, Louise Brown, was born; cloning Dolly took more than twice that. Imagine, say opponents, how many embryos would be lost in the effort to clone a human. This loss is mass murder, says David Byers, director of the National Conference of Catholic Bishops' commission on science and human values.

The risks involved with cloning mammals are so great that Wilmut, the premier cloner, calls it "criminally irresponsible" for scientists to be experimenting on humans today. Even after four years of practice with animal cloning, the failure rate is still overwhelming: 98% of embryos never implant or die off during gestation or soon after birth. Animals that survive can be nearly twice as big at birth as is normal, or have extra-large organs or heart trouble or poor immune systems. Dolly's "mother" was six years old when she was cloned. That may explain why Dolly's cells show signs of being older than they actually are--scientists joked that she was really a sheep in lamb's clothing. This deviation raises the possibility that beings created by cloning adults will age abnormally fast.

Wilmut believes that "it is almost a certainty" that cloned human children would be born with similar maladies, leading to, amongst other things, premature death. "It seems such a profound irony," he says, "that in trying to make a copy of a child who has died tragically, one of the most likely outcomes is another dead child."

Abuse:

A field where emotions run so strong and hope runs so deep is fertile ground for profiteers and charlatans. In her effort to clone her daughter Olga, Tanya Tomusyak contacted an Australian firm, Southern Cross Genetics, which was founded a few years ago by entrepreneur Graeme Sloan to preserve DNA for future cloning. In an e-mail, Sloan told the parents that Olga's teeth would provide more than enough DNA -- even though that possibility is remote. "All DNA samples are placed into computer-controlled liquid-nitrogen tanks for long-term storage," he wrote. "The cost of doing a DNA fingerprint and genetic profile and placing the sample into storage would be \$2,500. Please note that all of our fees are in U.S. dollars."

It turned out that Sloan didn't even have a scientific background and was just in the business to make a buck²¹.

But it is not just money which is at stake. Once parents begin to entertain the option of holding on to some part of a child, why should they not want to hold on to their parents as well. "Bill" is a guidance counselor in Southern California who is interested in cloning his mother, who is dying of pancreatic cancer. He has talked to her husband, his siblings, everyone except her doctor -- and her, for fear that it will make her think they have given up hope on her. He confides, "We might end up making a decision without telling her."

"She really didn't have the opportunities we had in the baby-boom generation, because her parents experienced the Depression and the war," he says. "So the feeling is that maybe we could give her some opportunities that she didn't have. It would be sort of like we're taking care of her now. You know how when your parents age and everything shifts, you start taking care of them? Well, this would be an extension of that."

Unforeseen Dangers:

Many ethicists have concluded that even people who think they know about cloning--let alone the rest of us--don't fully understand its implications. Cloning, notes

²¹ Time Magazine

ethicist Arthur Caplan of the University of Pennsylvania, "can't make you immortal because clearly the clone is a different person. If I take twins and shoot one of them, it will be faint consolation to the dead one that the other one is still running around, even though they are genetically identical. So the road to immortality is not through cloning."

Those who believe that the soul enters the body at the moment of conception think it is fine for God to make clones; he does it about 4,000 times a day, when a fertilized egg splits into identical twins. But when it comes to massaging a human life, for the scientist to do mechanically what God does naturally is to interfere with his work, and no possible benefit can justify that presumption.

Ian Wilmut, the scientist who cloned Dolly and has come out publicly against human cloning, was not trying to help sheep have genetically related children. "He was trying to help farmers produce genetically improved sheep," notes Hastings.

After the first one, everyone will accept.

Of course, attitudes often change over time. The team that cloned Dolly waited until she was seven months old to announce her existence. Creating her took 277 tries, and right up until her birth, scientists around the world were saying that cloning a mammal from an adult cell was impossible.

Says British futurist Patrick Dixon. "The law of genetics is that the work is always significantly further ahead than the news."

In-vitro fertilization was effectively illegal in many states 20 years ago, and the idea of transplanting a heart was once considered horrifying. Public opinion on cloning will evolve just as it did on these issues, advocates predict. But in the meantime, the crusaders are mostly driven underground. Princeton biologist Lee Silver says fertility specialists have told him that they have no problem with cloning. "But I think what they are hoping is that some fringe group will pioneer it and that it will slowly come into the mainstream and then they will be able to provide it to their patients."

All it will take, some predict, is that first snapshot. "Once you have a picture of a normal baby with 10 fingers and 10 toes, that changes everything," says San Mateo, Calif., attorney and cloning advocate Mark Eibert, who gets inquiries from infertile couples every day. "Once they put a child in front of the cameras, they've won." "On the other hand," notes Gregory Pence, a professor of philosophy at the University of Alabama at Birmingham and author of *Who's Afraid of Human Cloning?*, "if the first baby is defective, cloning will be banned for the next 100 years."

REACTIONS OF GOVERNMENTS, THE CLERGY AND ETHICISTS

Governments:

The immediate response to Dolly's birth was a revulsion against the idea of using the same technique to clone human beings. Some 19 countries immediately banned the practice; with the U.S. eventually following with a ban on federal funding but with no outright ban yet.

In June 1997, President Clinton, following the recommendations of his National Bioethics Advisory Commission, which had concluded that human cloning would be unsafe and therefore unethical "at this time," signed a five-year moratorium on the use of federal funds for human cloning research.

Although legally, there's very little to stop scientists from cloning today, President Bush strongly supports legislation banning human cloning. In January, the National Academy of Sciences recommended a ban on human cloning, but only four states -- California, Michigan, Louisiana and Rhode Island -- ban any type of cloning research. The Food and Drug Administration claims it has jurisdiction over human cloning based on the Public Health Service and Food, Drug and Cosmetic Act. It claims it would regulate the cloning process like a drug.

Germany and Britain are amongst those countries which have banned cloning. Others have legislation pending that would ban it or restrict it, such as Sweden, where the government is drafting legislation that would ban reproductive cloning but allow "therapeutic" cloning.

The United States has proposed a UN treaty banning all human cloning. France and Germany have proposed an alternative which would ban only cloning to produce babies, leaving the question of cloning for research and medical experiments for future consideration.

On Friday, French President Jacques Chirac vigorously condemned the announced birth and repeated calls for a worldwide ban on attempts to clone humans, which he said was "contrary to the dignity of man."

Scientists:

Many animal cloners -- including Ian Wilmut, the Scottish researcher who successfully cloned the first animal, Dolly the sheep, in 1997 -- disapprove of human cloning. Wilmut has said it took 276 failed attempts before Dolly was successfully cloned. "It is not responsible at this stage to even consider the cloning of humans," said Rudolf Jaenisch, a biologist at MIT's Whitehead Institute for Biological Research, which clones mice.

Jaenisch said that even if a human clone appears healthy, it may not be once it gets older. Cloning a human at this point, he said, without knowing more about why things go wrong, is "essentially using humans as guinea pigs, and one shouldn't do this."

According to Dr. Jon Hill, a veterinarian who successfully cloned cows at Texas A&M University, even clones who appear normal at birth often develop problems afterward. "Their livers, their lungs, their heart, their blood vessels are often abnormal after birth," Hill said.

Religious Leaders:

In Jerusalem, Israel's Chief Rabbi Israel Meir Lau said that in principle, Judaism favors technological developments and medical progress that can help save a life or solve infertility problems. But it rejects the artificial creation of life.

"The moment medical science tries to take upon itself duties and areas which are not its responsibility such as shortening life, cloning, or creating life in an unnatural way we must set down borders in order not to harm the basic belief that there is a Creator of the universe in whose hands life and death are placed," a statement from Lau's office said.

The Roman Catholic Church has long condemned any research that involves creating and experimenting with human embryos, the vast majority of which inevitably perish. The church believes that the soul is created at the moment of conception, and that the embryo is worthy of protection. The Vatican joined leading Muslim clerics and Jewish rabbis in denouncing as immoral, "brutal" and unnatural the claim that a cloned baby had been born. Political leaders, meanwhile, stepped up calls for a global ban on human cloning.

Before his death, New York Bishop John Cardinal O'Connor wrote: Is cloning human beings morally permissible? Categorically no.... I offer three, not exhaustive, basic reasons

for my belief: 1. Cloning is a drastic invasion of human parenthood. By design, a clone technically has no human parents, hence creating a clone violates the dignity of human procreation, the conjugal union (marriage) and the right to be conceived and born within and from marriage. A clone is a product made, not a person begotten. 2. The Scottish cloned sheep, Dolly, came into being on the 300th attempt. The first 299 attempts essentially fell apart. Switch to human beings....How many human beings will be destroyed before whose ideal is achieved? 3. Who does the cloning? Who owns the clones? Are they to be marketed? Is the idea of clone-slaves, or clones created to meet particular needs of warfare, ridiculous? I think not.... Cloning will never be a poor people's campaign. Could it become an entitlement requiring public subsidy? Of itself it cures no pathology. Thus we are not doctoring the patient but the race²²."

"The announcement in itself is an expression of a brutal mentality, devoid of any ethical and human consideration," said the statement from papal spokesman Joaquin Navarro-Valls. Vatican teaching holds that life begins at conception.

"The cloning of human embryos for the purpose of performing destructive research and experimentation, such as that which just occurred today of 'Baby Eve,' is an aberration. It shows a total lack of respect for life and must be prevented," said Roberta Combs, president of the Christian Coalition of America.

This article is based on the N.Y. Times, Feb. 2001, Leslie Roberts in U.S. News & World Report, January 17, 2000 and Joannie Schrof Fischer on March 27, 2000, Scientific American, Jan. 2002, Stephen Clark in Philosophy Now, August/September 2000, Sharon Begley Newsweek, October 16, 2000, Cloning the Endangered, CNN, December 28, 2002, Associated Press, Dec. 27, 2002, The Journal of Halacha and Contemporary Society, number xxxiv (Fall, 1997) Cloning People and Jewish Law: A Preliminary Analysis, by Rabbi Michael J. Broyde and more.

²² Will Cloning Beget Disaster?, The Wall Street Journal, Friday, May 2, 1997