

Human Cloning

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When values of ethics and the concepts of technology go head to head, there is no issue more controversial than that of human cloning.

What is Cloning?

Cloning simply put is the process of creating an identical copy of something. According to The National Bioethics Advisory Commission, cloning in terms of biology is "the making of identical copies of molecules, cells, tissues, and even entire animals." The commission refers to human cloning as the asexual replication of an individual human being at any stage of development [1]. In the political arena, human cloning is defined by U.S. Senator Campbell as: "the terms 'clone' and 'cloning' mean the practice of creating or attempting to create a human being by transferring the nucleus from a human cell from whatever source into a human egg cell from which the nucleus has been removed for the purpose of, or to implant, the resulting product to initiate a pregnancy that could result in the birth of a human being" [1]. As defined human cloning has not been achieved however the success of cloning animals is making human cloning a possibility. In general there are three different types of cloning.

DNA or Molecular Cloning

The term DNA cloning refers to "the transfer of a DNA fragment of interest from one organism to a self-replicating genetic element such as a bacterial plasmid "[2]. It is also referred to as

“molecular cloning” , “gene cloning” or “recombinant DNA technology” . In DNA cloning, genes are cloned using cloning vectors (self replicating DNA molecules) such as plasmid bacterium. The procedure involves cutting the required gene from chromosomal DNA and uniting it with a cloning vector that has the same cut. This united cloning vector is called the “recombinant DNA molecule”. The recombinant DNA starts reproducing the desired gene once it is introduced into suitable host cells [2]. DNA Cloning is beneficial because it provides numerous identical genes for study [1]. It has been practiced for decades and has helped create medicines such as insulin and tissue plasminogen activators (tPA) [1].

Therapeutic Cloning

Therapeutic Cloning involves creating an embryo and allowing it to grow numerous stem cells. These stem cells are removed from the embryo resulting in the death of the embryo. After its extraction, stem cells can be made to grow into any tissue or organ which can then be transplanted into a patient [3]. “Stem cells are important to biomedical researchers because they can be used to generate virtually any type of specialized cell in the human body”[2]. Scientist hope that stem cells can be used to help cure heart disease, Alzheimer’s and cancer[2]. However, due to the destruction of the embryo therapeutic cloning raises lot of ethical concerns.

Reproductive Cloning

Reproductive cloning is the process in which an actual living organism is cloned whereas DNA cloning only clones genes and therapeutic cloning only clones specific cells, organs and human body parts [7]. Reproductive cloning is similar to therapeutic cloning, however in reproductive cloning the embryo is not destroyed. In a process called “somatic cell nuclear transfer”(SCNT) the embryo is transferred into a surrogate mother instead of being destroyed. SCNT is a four part procedure. First, a egg is obtained from a female and the nucleus of the egg is then removed. Second, a nucleus from a donor adult cell is taken and fused with the egg that has no nucleus; this resulting egg has the genetic material of the donor. Third, the egg is stimulated by chemicals or electricity so that it begins cell

division. Upon reaching cell division the egg can be referred to as an embryo. Finally, during cell division if the embryo reaches a suitable stage, it is planted into the uterus of a female where it stays until birth [2]. Dolly, the infamous sheep, was conceived using this procedure. Reproductive cloning does not produce strictly identical clones because the DNA of the mitochondria in the cells comes from the egg and not from the nucleus of the donor adult cell [7]. Scientists have used reproductive cloning to produce numerous animal clones however the success rate is very low. Reproductive cloning along with DNA and therapeutic cloning have been practiced for a long time.

History

The history of human cloning dates all the way back to 1962, when John Gurdon, a biologist at Oxford University claimed that he had cloned South African frogs using adult intestinal cells. His work opened up many doors in this new field [4] and invited many more researchers into the field. The next biggest breakthrough occurred in 1977 when a Karl Illmansee, a German developmental biologist created a mouse with a single parent. But soon after his creation, there were many successions of failure that occurred and started to convince scientists that mammals cannot be cloned. Two years later, in 1979, Karl Illmansee broke this widespread doubt by claiming to have cloned three mice. With this new inspiration, the flames of scientists' hope to clone a mammal rekindled as they then attempted to clone sheep from adult cells in 1984. By 1986, they were able to clone sheep and a cow using respective animal embryo cells. And finally in 1996, the breakthrough occurred when the scientists cloned their first mammal, a sheep, from adult somatic (donor) cells [4]. And resulting from the success of cloning, there arose a bundle of false beliefs.

Misconceptions

There exists a great deal of misconceptions in the minds of the public regarding human cloning starting from machines popping out exact replicas to the rebirth of Hitler. How many of you think of a clone as a replica of yourself and make it a subordinate of yourselves? This is the most common misconception people have when asked about human cloning. When you clone yourself, your clone has

to go through the embryonic process just as you did in your childhood. Most people seem to presume that clones emerge fully-grown from womb tanks or some such contraption. So it's not like your clone is your twin, its more like it's your child!! By the time your clone turns 21, you will be 42 years old. Another popular misconception is that people want to promote cloning so that they can replicate their favorite celebrities and have more of them around. The flaw here is that when you clone your favorite athlete or idol, it is not bound that they will turn out the same. For example, if you clone Michael Jordan, its not certain that he will became a basketball player. For all we know of cloning, he could turn out to be a future tennis star or a great lawyer or even a mere pauper because of the environmental changes and mode of nurturing. The same Michael Jordan can end up being even a murderer if raised in negative environments. Nothing is quite certain of human cloning in the present state of technology; anything can happen and the possibility of creating a favorite, and an accurate clone is very slim. For example, it took more than 277 attempts before "Dolly" was created as a health viable lamb. All the other attempts of Dolly were severely retarded, or died in a very short time. If it took that many times to replicate a sheep to perfection, imagine how extremely hard it will be to clone a human to perfection. The concept of resurrecting people from the dead using human cloning is also a pervasive misconception. "Shortly after Dolly the Sheep was cloned, the Guardian ran an article featuring a man who claimed that cloning might be able to provide a route to immortality" [5]. People claim that if a few cells of the dying person is obtained, we could clone them and hence cheat death itself. But it doesn't work that way, they are faltering to notice a false conception previously mentioned that a person produced by cloning will actually be born as a baby. Most people's feelings towards human cloning are mainly relied on misconceptions like these. But instead people should form their bias by its advantages and disadvantages.

Benefits-Advantages

Cloning in its full potential has a lot of benefits and advantages. It can be used to provide organs for transplant [6]. For example, there was a case in San Francisco in 1988, when a girl called

Anissa suffered from cancer and the only therapy was to kill all the stem cells by high toxic. Unable to live without stem cells, her parents tried to find suitable bone marrow for transplantation but failed to do so. So they decided to have another baby which may provided suitable bone marrow. (The comparability is 25%.) They performed the bone marrow transplantation when her sister was 14 month old. 5 years later, Anissa recovered [8]. Likewise it is also helpful in genetic modification and engineering. Cloning is also instrumental to help understand about genetic diseases and help prolong human longevity. It also reduces all the worrying regarding the child's health because scientists can now alter a child's genes to ensure it a healthy life. "For example, if a mother has given birth to 2 children which suffered from Downs syndrome. Doctors can manipulate and balance out the number of chromosomes in the embryo to give the mother a normal and healthy child" [6]. However, the primary advantage in promoting human cloning would be its potential to solve infertility. "About 15% of Americans are infertile, and doctors usually cannot help them. Federal statistics show that in vitro fertilization and relate technologies have a success rate of less than 20%."(6) Scientists believe that human cloning could provide the breakthrough here by helping infertile women conceive by implanting a cloned embryo in their bodies.

Dangers

Granted that cloning is very beneficial to the present world, it poses many more dangers and threats. Cloning has a 90% failure rate. With such high failure rates, it is very dangerous to implement it on human beings. Failures include pregnancy failure, stillborn and deformed clones. Furthermore, clones that are born normal might have subtle abnormalities that cannot be detected until years later [16]. Even if we somehow perfect the technology to clone human beings without defects, it still has potential threats such as overpopulation, identity crisis, even the virtue of life is lost. Say for example, if human cloning is perfected, anyone might want a "mini-me" (watch out Austin Powers!!) of themselves and increase the world population dramatically depleting numerous resources. In addition, cloning could also lead to lack of genetic diversity, thus making the human race vulnerable to racial

extinctions.

Ethical Objections

Despite having numerous dangers, human cloning also faces a lot of ethical concerns. The President's Council on Bioethics splits ethics on human cloning into two separate categories. One, ethics regarding cloning humans for children (reproductive cloning). Two, cloning human embryos for research (therapeutic cloning). The council provides several arguments that state that human cloning for children or reproductive cloning is unethical [16]. First, human cloning procedure has not achieved the safety level required to make it ethical. "Safety concerns revolve around potential dangers to the cloned child, as well as to the egg donor and the woman who would carry the cloned child to birth" [16]. Second, human cloning arises the ethical problem of consent. "Consent from the cloned child-to-be is of course impossible to obtain, and because no one consents to his or her own birth, it may be argued that concerns about consent are misplaced when applied to the unborn" [16] Finally, reproductive cloning can lead to exploitation of women. Animal cloning has shown us that the process of reproductive cloning requires several hundred eggs before a successful clone [16]. These eggs are obtained from females through hormonal injection [2]. Human cloning would require women to provide these eggs. It is highly unlikely that women would volunteer their eggs thus resulting in financial incentives for female eggs. These incentives would lead poor women to take the risk. "Research on cloning-to-produce-children could impose disproportionate burdens on women, particularly low-income women" [16]. The council also provides arguments that state that cloning for research or theoretical cloning is unethical. Perhaps the strongest argument against human cloning is that it involves the "production, use, and intentional destruction of cloned human embryos" [16]. The central question posed here is that "Is destroying a human embryo the same as killing a child?" The President's Council on Bioethics believes "there are sound moral reasons for not regarding the embryo in its earliest stages (certainly in the first fourteen days) as the moral equivalent of a human person, though it does command significantly more respect than other human cells" [16]. The concern shared

by many is that if experiments on early stages of embryo is allowed, scientists might abuse their limits and conduct research on developed embryos. Similar to reproductive cloning therapeutic cloning can also lead to exploitation of women. Like most research projects, cloning for research would need to be funded. If financial gains, and not human good, is the main motive for human cloning, then the nature cloning would not be that different from the nature of corporations [1]. These ethical concerns of human cloning have moved from the academic arena to the political arena.

The Congress

On February 27, 2003 the US House of Representatives voted to ban the cloning of human embryos for any reason [9]. Congressmen Jim Greenwood and Peter Deutsch proposed an amendment that stated that human embryo should be cloned but not be used to “initiate a pregnancy”. Their amendment was not considered. In the senate, debate over the benefits of therapeutic cloning (cloning to cure diseases) kept the proposal from passing. Most recently on June 6, 2007 the house failed to pass H.R. 2560 - the bill stated that all human cloning is illegal and transporting and shipping products of cloned egg cell is illegal [10]. The bill also assessed a penalty of 10 years in prison and up to \$10 million dollars in fines. Additionally on June 5, 2007 the House introduced H.R. 2564: Human Cloning Prohibition Act of 2007, to amend United States code to prohibit human cloning. On July 16, 2007 this bill was referred to the subcommittee on Crime, Terrorism, and Homeland Security [11]. It is still in committee and has not been scheduled for debate yet. The senate introduced S.812: Human Cloning Ban and Stem Cell Research Protection Act of 2007 on March 8, 2007. This bill would protect stem cell research but ban human cloning [11]. The Senate also introduced S. 1036: Human Cloning Prohibition Act of 2007 on March 29, 2007; it would amend the Public Health Service Act to prohibit human cloning. Both the Senate bills are in different committees and have not been scheduled for debate yet. Congress for the most part agrees that human cloning to “initiate pregnancy” is wrong, dangerous and should be illegal. The debate and conflict is in the area of therapeutic cloning. There is strong disagreement when it comes to cloning human embryos for research.

President Bush's Stand

Perhaps the strongest opposition for human cloning comes from President Bush. "President Bush has repeatedly called on Congress to ban all human cloning" [9]. The President believes that human embryos are living organisms thus destroying them for research purposes would create enormous ethical problems and would constitute as murder. In his State of the Union address on February 2, 2005 the President said, "I will work with Congress to ensure that human embryos are not created for experimentation or grown for body parts, and that human life is never bought or sold as a commodity. America will continue to lead the world in medical research that is ambitious, aggressive, and always ethical" [9]. President Bush's opinion has met with mixed feelings from the state.

The States Regulations

As of April 18, 2006 there are 15 states with laws on human cloning. Missouri and Arizona prohibit public or state money to fund reproductive human cloning [12]. Arkansas , California , Connecticut , Indiana, Iowa , Maryland , Massachusetts , Michigan , New Jersey , North Dakota , Rhode Island , South Dakota , and Virginia all have laws that prohibit reproductive human cloning [12]. Arizona also prohibits use of public money for therapeutic cloning. Out of the above mentioned states, Arkansas , Indiana , Iowa , Michigan , North Dakota , South Dakota also prohibit therapeutic human cloning (cloning of human embryos for research but not for pregnancy.) [12]. However, California, Connecticut , Maryland , Massachusetts , Missouri , New Jersey and Rhode Island do not have laws banning therapeutic human cloning [12].

International Community

On March 8, 2005 the UN called on all governments to ban all forms of human cloning [13]. The declaration was not well received by Asian and European countries. Countries such as Britain, Belgium, and China support therapeutic human cloning. They argue that cloning human embryos for research can cure a host of diseases such as Alzheimer's, Parkinson's and diabetes [13]. On the other side the declaration was welcomed by United States and also by many other Catholic countries. The

debate on human cloning has just begun and one can expect this debate to get hotter and hotter in the near future.

Future of Cloning

Although human cloning faces a lot of opposition the future for human cloning does seem bright. On November 13 2007 scientists in Oregon were able to clone monkey embryos and extract their embryonic stem cells [14]. This achievement is important because monkeys are the closest lab animals to humans. If this technique can be achieved for human embryos there is a great potential for development in the medical community because embryonic stem cells can be developed into any other cell in the body, thus patients needing organ transplant can get cloned organs from their cells and avoid facing the problems of immune rejection [14]. Another major breakthrough in human cloning came on November 21, 2007 when NPR broke the news that scientists were able to create embryonic stem cells from skin cells instead of an embryo [15]. This achievement is important because the main argument against therapeutic cloning is that it kills human embryos. This technique bypasses the human embryo thus dogging the ethical concerns raised by many. The discovery was made separately by Dr. Shinya Yamanaka of Kyoto University and by Junying Yu, of the University of Wisconsin-Madison [15]. The discovery is still in its first stages and has yet to be converted into benefits [15].

The future of human cloning holds a lot of promises; promises of a healthier, safer and better life. However, human cloning does have many dangers and ethical problems. But in the future, there is hope that technological advances may make it possible for human cloning to satisfy our necessary ethical inquires as well as eradicate any potential risks.

Work Cited

1. Logston, Amy . "THE ETHICS OF HUMAN CLONING." Fr. Thomas Hart, O.S.B.
13 Jan 1999 23. 21 Nov 2007.
<<http://facweb.stvincent.edu/academics/religiousstu/writings/logston1.html>>.
2. Mansfield , Betty K.. "Cloning Fact Sheet ." Human Genome Project Information. 26 Jan 2006.
Human Genome Program. 32 Nov 2007
<http://www.ornl.gov/sci/techresources/Human_Genome/elsi/cloning.shtml>.
3. Robinson, B. A.. "Therapeutic cloning: How it is done; possible benefits." Religious Tolerance.
29 Oct 2005. Ontario Consultants on Religious Tolerance. 28 Nov 2007
<http://www.religioustolerance.org/clo_ther.htm>.
4. "History of Cloning" 19 Nov 2007. <<http://home.hawaii.rr.com/johns/history.htm>>.
5. Wynn, Rebecca . "Hello Dolly, Hello Dolly: Human Cloning, Ethics and Identity."
Reproductive Technologies. ProChoiceForum. 26 Nov 2007
<<http://www.prochoiceforum.org.uk/ri4.asp>>.
6. "The Advantages of Cloning." Cloning the future. ThinkQuest Internet Challenge team . 22
Nov 2007 <<http://library.thinkquest.org/C0122429/ethics/advantages.htm>>.
7. "Cloning." Wikimedia. 30 Nov 2007. Wikimedia Foundation, Inc., 30 Nov 2007
<<http://en.wikipedia.org/wiki/Cloning>>.
8. Raeburn, Paul . "The Copy Shop." The New York Times 11 Jan 1998 1-2. 21 Nov 2007
<<http://query.nytimes.com/gst/fullpage.html?res=9F05E5DD1F31F932A25752C0A96E958260>>
9. "Human Cloning Legislation in Congress: Misconceptions and Realities." National Right to Life. 21 May 2005. Federal Legislation Department at the National Right to Life
Committee (NRLC). 30 Nov 2007
<http://www.nrlc.org/killing_embryos/cloningbackrounder021003.html#Past_Developm>

ents_in_Congress_>.

10. GovTrack.us. H.R. 2560--110th Congress (2007): Human Cloning Prohibition Act of 2007,

GovTrack.us (database of federal legislation) Nov 22, 2007.

<<http://www.govtrack.us/congress/bill.xpd?bill=h110-2560&tab=summary>>

11. GovTrack.us. H.R. 2564--110th Congress (2007): Human Cloning Prohibition Act of 2007,

GovTrack.us (database of federal legislation) Nov 22, 2007.

<<http://www.govtrack.us/congress/bill.xpd?bill=h110-2564>>

12. Johnson, Alissa. "The Forum of America's Ideas." State Human Cloning Laws. 18 Apr 2006.

National Conference of State Legislatures. 21 Nov 2007

<<http://www.ncsl.org/programs/health/genetics/rt-shcl.htm>>.

13. Lynch, Colum . "U.N. Backs Human Cloning Ban." The Washington Post 09 Mar 2005 1. 22

Nov 2007. <<http://www.washingtonpost.com/wp-dyn/articles/A18205-2005Mar8.html>>.

14. Cyranoski, David. "Cloned monkey stem cells produced." Nature News 14 Nov 2007 (1-8). 19

Nov 2007 <<http://www.nature.com/news/2007/071114/full/news.2007.245.html>>.

15. Palca, Joe. "Deriving Stem Cells From Skin, Not Embryos." Research News. NPR. 30 Nov 2007

<<http://www.npr.org/templates/story/story.php?storyId=16511934>>.

16. "Human Cloning and Human Dignity: An Ethical Inquiry." The President's Council on

Bioethics. July 2002. The President's Council on Bioethics. 19 Nov 2007

<<http://www.bioethics.gov/reports/cloningreport/index.html>>.