Cloning and Humans: Technology, Ethics and Possible Impacts

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Overview

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Introduction

- In 1952, a tadpole was the first animal ever cloned.
- In 1997, when Dolly the sheep was successfully cloned, the possibilities of human cloning were realized by scientists.
- Research on cloning continues to occur to this day, however cloning a human is banned due to ethical concerns and the arguments it brings up.
Technology and Methods

There are three main cloning technologies currently used.

- Recombinant DNA technology
- Therapeutic cloning technology
- Reproductive cloning technology
Recombinant DNA technology

- It involves the transfer of a fragment of DNA from one organism to another.
- The fragment is firstly removed from the target DNA and inserted into a plasmid.
- The plasmid is inserted into a foreign host cell.
- This technique is used widely in genetic engineering and biology labs.
Therapeutic cloning

• In this technique, embryos are cloned for the purpose of research.
• Stem cells, which can be transformed into specialized cells are harvested from the human embryos.
• The stem cells are used to study human development for research by biomedical in hopes of developing replacement tissues and organs.
Reproductive cloning

• In this technique an organism which is the genetically identical to another organism is created.

• Somatic cell nuclear transfer (SCNT) is the process that is usually used for his procedure. There are two main techniques, the Roslin technique and the Honolulu Technique.

• Somatic cell nuclear transfer involves removing the nucleus of an egg cell and inserting the nucleus of a foreign somatic cell.
The Roslin Technique

- Developed at Roslin Institute in Scotland.
- Dolly was cloned using this technique.
- Donor somatic cell placed in limited nutrients to make it dormant.
- The cell shuts down but doesn’t die and the nucleus is then able to be accepted by the enucleated egg cell.
- This is done by cell fusion induced by an electric current.
- The electric impulse activates formation of an embryo which is transplanted into the uterus a surrogate mother to grow.
Roslin technique

Step 1: isolation of donor cell

- Isolation of donor cell

Step 2: fusion of donor nucleus and enucleated egg cell

- Fusion of donor nucleus and enucleated egg cell
- Scottish Blackface enucleated oocyte
- Finn Dorset mammary cell nucleus
- Injected donor nucleus
- Zapped with electricity to make the nucleus fuse with the cytoplasm
- “New Cell” placed into a ewe’s reproductive track to grow

Surrogate “mother”
Honolulu technique

- Developed at the University of Hawaii Honolulu, by Teruhiko Wakayama and Ryuzo Yanagimachi.
- More or less same as Roslin technique.
- However in this technique, as electric current is not applied for cell fusion.
- The donor cell’s nucleus is transferred into the enucleated egg cell by transplantation.
- The new cell is left to sit in chemicals for a few hours.
- The chemicals activate cell division, forming an embryo which is then transferred into the womb of a surrogate mother.
- Safer and has a higher success rate than Roslin technique.
How to clone a human

1. Remove chromosomes from an egg
2. Adult cell against an egg
3. Spark of electricity
4. Implant twin embryo in surrogate mother
Pros of Cloning

- Cloning *plants and animals* will create a nearly infinite number of research subjects for use in fields like genetics, evolution and cause/effect behavior.
- Cloning *plants and animals* will also create an almost limitless source of food for humanity.
- The successful cloning of *humans* will bring about a huge advance in modern medicine and eliminate the “waiting list” for organ transplants.
- *Human* cloning will also create the most miraculous solution ever known for infertile couples.
- The developments that come from knowledge on cloning can even lead to help humanity eliminate genetic diseases and “weak genes”, therefore going beyond average human capabilities.
Cons of Cloning

- Cloning is expensive and requires a lot of dedicated funding, and many argue that the money is better spent in other areas of national and global need.
- Cloning a whole human being is pretty unrealistic because of our current technological constraints, and could be considered a huge waste of money because of it.
- Cloning *animals* will probably bring up arguments about animal rights violations.
- Anything created in a lab through cloning could be patented, marketed and sold like any other normal piece of property on earth.
- Hidden motives of people with great power can lead to gross misuse of cloning to create armies of soldiers and even clones of themselves so their reign can continue forever.
Short-term Effects of Cloning

- The developing field might get a surge of funds from companies that are desperate to get some control on the groundbreaking technology.
- Certain diseases will be researched and better understood. Cures to major diseases will be that much closer to reality.
- Infertile couples will welcome the developing technology in hopes of having children of their own some day.
- Development of specialized cells and whole organs will bring modern medicine into a new era of development and practice.
- Arguments on morality and ethical viewpoints regarding cloning will bring up heated discussions, for better or for worse.
Long-term Effects of Cloning

- Psychological effects of being born a clone of another person cannot be determined without taking the unknown risks associated with cloning a human in the first place.
- Technology will probably advance to the point of making a market out of genes and “buying” the ideal child.
- Some major physical side effects that a clone experiences might not be revealed until later in their life when it is too late to stop from debilitating or killing the clone.
- The “gene pool” might become significantly smaller and a disease that affects those genes can cause an epidemic that can nearly wipeout humanity.
Ethics: Arguments for Cloning

- Cloning for autonomy where everyone should be able to determine the fate of their cells.
- Allows infertile and/or nontraditional couples to have children of their own.
- Society can be improved by not resisting or fearing new technology.
- Prohibiting cloning would violate the fundamental freedom of scientific inquiry.
- It is unfair and unwise to use arguments of risks and high costs to discourage these new techniques.
If an embryonic cell is of equal importance as that of any other cell that yields benefits, then embryonic cells should be worked with to yield beneficial results too.

Technically, an embryo must show brain development or some form of consciousness before it is more than just a mass of cells that can be manipulated.

This technology can produce life saving results therefore making it ethical to continue research in the area.
Ethics: Arguments against cloning

- Embryonic cells should have rights and privileges based on their special ability to produce human life.
- Application of this technology may be biasly distributed.
- This technology creates life for the purpose of destroying it.
- Cloning violates the right to individuality and identity, and the sacredness of the human body.
Ethics: Arguments against cloning (contd)

- It is a eugenic process which would decrease genetic diversity and allow for “manufactured humans”.
- Allows scientists to play the role of “God”
- Clones may be worse off in terms of physical and psychological wellbeing and health.
- Human cloning is liable to abuse by mankind.
Conclusion

- Cloning is the replication of genetic material (DNA); although a genetically identical organism is formed, the clone will not possess the same psychological characteristics.
- The three cloning technologies are recombinant DNA, therapeutic cloning, and reproductive cloning.
- Future research can yield successful cloning of whole human beings.
- The positive results of cloning technology include finding the means to cure major diseases and produce organs for transplanting, while the negative results include the high costs associated and the possible misuse by people with hidden agendas.
- In the near future, precious funding will be diverted to this kind of research and organ transplant “waiting lists” will be nearly eliminated, while in the long run, the mental health of those cloned humans is unpredictable and the loss of genetic diversity could harm humanity.
- With regards to ethics, cloning is currently considered unethical because it involves the manipulation of embryos.
- However, these beliefs are contrasted by the great benefits it can provide to society.