The Ethics of Human Genetic Cloning

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In 1971, James Watson and Frances Crick opened the doors to genetics research with their discovery of the double helical structure of DNA. Genetics has been widely explored since then, especially through new technological advancements. Many of the efforts made in this field have illuminated the genetic basis of human development and disease.

Nevertheless, the presence of such sophisticated levels of technology did not prepare the public for the announcement on February 24, 1997, that Scottish scientist Ian Wilmut at the Roslin Institute had successfully cloned a lamb named Dolly. The news of this sheep being genetically identical to her sole parent spread around the world. As though fantasy became reality, an outpouring of publications began to speculate on the possibility of human cloning and the ultimate formation of a "master" race. Meanwhile, bioethicists, religious activists, and humanitarians galvanized to protest further research in genetic cloning. Within days of the big announcement, President Clinton instituted a federal ban on cloning, and the National Bioethics Advisory Commission (NBAC) was immediately sought to address the concerns of genetic cloning.

Since Dolly's creation, the issue of genetic cloning still remains as one of the most controversial subjects, attracting a wide variety of opinions and beliefs. This article will provide an overview of genetic cloning and then examine some of the ethical concerns and implications of cloning for the global community.

The concept of cloning is not a new one. Derived from the Greek term meaning "twig," the word cloning refers to the long-established technique of striking a cutting, as is usually done in commercially grown fruit trees.[1] In biological research, "cloning" generally refers to a duplicate genetic copy of another biological object, be it DNA sequences, cells, or multicellular organisms. For living animals, this term is ambiguous because various types exist—molecular cloning, cellular cloning, embryo twinning, blastomere separation, and nuclear somatic transfer (NST).[2] At the most basic level, the replication of DNA in a host bacterium is called "molecular" cloning. In "cellular" cloning, copies of a cell are made in the laboratory to form cloned cells called a cell line.

"Embryo twinning" results when a sexually formed embryo splits into two identical halves. "Blastomere separation" pertains to splitting a developing embryo at the composition of 2-8 cells. Each cell, known as a blastomere, is identical and genetically capable of producing an entire new organism. The technique of replacing the haploid nucleus of an egg with a diploid one is known as NST.

Early studies focused on cell differentiation and the regulation of gene expression. In 1962, Robert Briggs and Thomas King reported successful nuclear transfer in the frog Rana pipiens using undifferentiated blastula cells and enucleated cells.[3] Gurdon showed that cells in later stages of development could also produce young.[4] These and other subsequent studies gave evidence that genes in the nuclei of differentiated cells could be reactivated by the cytoplasm of the egg at certain stages of development.[5] Then, in 1981, Karl Illmensee and Peter Hoppe claimed to have proven that the nuclei of adult mice cells could be inserted into mouse eggs to produce adult mice.[6] However, when the results were not reproducible, the public's interest in cloning began to decline.

Wilmut's research successfully cloned Dolly using a new technique that had never before been successful. Scientists fused mammary cells derived from a 6-year-old ewe with enucleated ewe oocytes using an electric current. Of the 277 fused cells produced in this manner, 29 survived and were implanted into the wombs of 13 sheep. Dolly was the only sheep born alive.[7] Since Dolly's debut, other cloned animals have followed, including cattle, goats, mice, and cows.[8]

Before questioning the ethical concerns of genetic cloning, it is important to correct popular misconceptions about cloning. First of all, cloning a human adult will not instantaneously produce a clone of the same size and age. Instead, the clone, born as an infant, can be regarded as a "delayed twin." More importantly, the clone is not a perfect replica of the original. This misunderstanding stems from the false idea that an individual's genes solely determine the physical and psychological traits of a person. Although the gene structure between the adult and the clone is very similar, there are some differences at the molecular level. For example, the network of neurons that essentially define an individual cannot be fully copied because the brain is too complex. As Gregory Pence, author of Who's Afraid of Human Cloning, eloquently writes, "The conclusion is inescapable: The problem of wiring up a brain is so complex that it is beyond the power of the genomic computer. The best the genes can do

is to indicate the rough layout of wiring, the general shape of the brain."[9] Furthermore, as the brain continues to develop after birth, the differences between the adult and the clone continue to shape their own individuality. The mitochondrial DNA from the host egg also harbors some genes that can affect the development of Dolly, but currently the effects are still unclear.

However, beyond the biological differences between an individual and a clone, the influences of cultural and societal experiences also make the two people different. The clone is born as an infant who grows up in an environment and time period that is different from the adult who was cloned. As a result, the clone's life experiences and relationships are unique, and they help develop the clone's personality and character. Since even human identical twins do not have identical personalities, neither would people and their clones.

Undoubtedly, the birth of Dolly raises public concerns about the ethics of human cloning. Some of these initial worries sprang from health and safety concerns, such as physical endangerment to the clone. However, a larger and more controversial class of concerns includes issues such as reproductive autonomy, freedom of individuality, the quality of parenting and family life, and medical applications of cloning. Let us now examine some of the biological and ethical arguments in favor and against human genetic cloning in these areas.

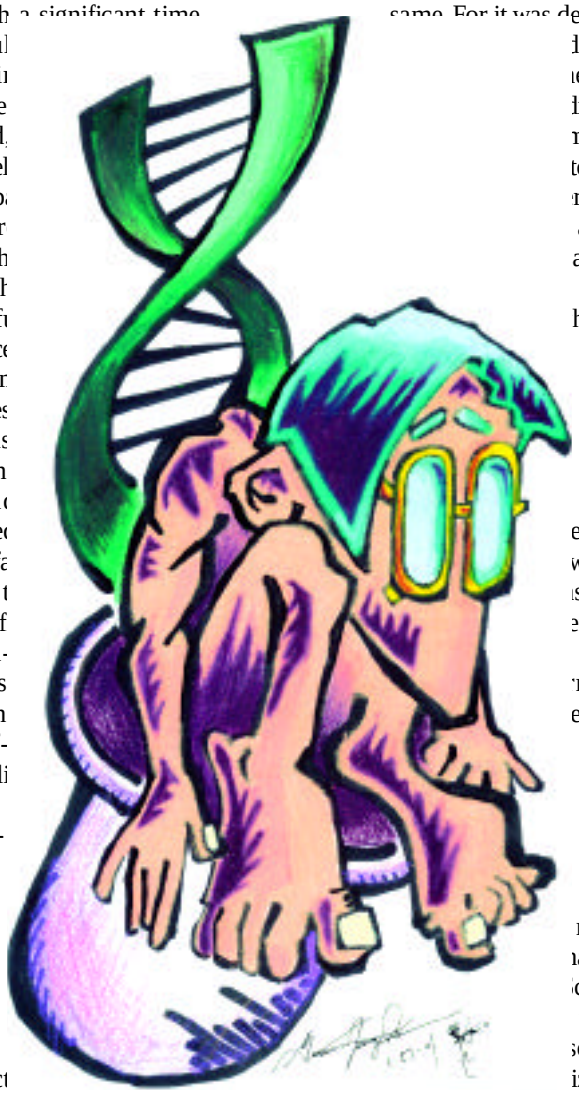
Critics contend that human cloning presents great safety risks not only to the clone, but also to the egg donor and birth mother. As Dolly was the only one out of 277 sheep to be born alive, the success rate of producing a human clone through the same technique would be very minute. Furthermore, the successful birth of the infant does not guarantee the absence of genetic mutations that may be detrimental afterwards. Additionally, the cloning procedure poses health risks to the birth mother, who may suffer miscarriages, as well as to the egg donor whose hormones have been manipulated.

To opponents of NST, the very idea of human cloning seems morally repugnant. It undermines family structures, questions the role of parenthood, and goes against nature. For such individuals, the thought of giving birth to an exact replica of a deceased relative or producing a clone for biological spare parts is repulsive. First, human cloning alters the stability of family structure—what should be the clone's name and title? Moreover, as bioethicist Leon Kass describes, all human societies have been based on traditional family relationships in which parents care for their offspring.[10] The ability to reproduce asexu-

ally, then, undermines the need to have two parents and can alter parent-child relationships. Cloning practices may harm the social values and practices that are necessary to the health of a child.

Another area of concern deals with the right to an open future.[11] According to philosopher Joel Feinberg, twins born simultaneously differ greatly from twins born with a significant time gap in between. Simul twins, who share very si lar genetic material, be their lives together, and the course of their devel ment, select their own p Their genetic backgr may help determine th come of their lives, but th no knowledge of their f In this sense, "ignorance the effect of one's genor on one's future is neces sary for the spontaneous free, and authentic con struction of a life an self."[12] However, a delaye twin already knows the f of the earlier twin, and knowledge may be suff cient to remove the spontaneity of the later twin's life, even if the later twin chooses a distinctly different path from the earli er twin.

Other people perceive cloning as a way of controlling the future, rather than submitting to the mysteries of life and nature. Since cloning technology may allow individuals to preselect the genetic information of the delayed twin, it takes away the profundity of a new life and acceptance of the child for who he is.[13] It also brings up the concern of eugenic engineering.[14] Although cloning does not necessarily result in the phenotypic expression of certain genes, there is still a fear that certain people will become more desirable than others, resulting in discrimination. Ultimately, there is a fear that cloning may one day become part of manufacture. Mass-scale cloning not only violates many human rights, but it also dehumanizes the wonder of reproduction into a form of commerce.



On the other hand, personal liberty is a highly held right in this democratic nation. Individuals choose when to have children and how many children to have. Some individuals feel that their personal autonomy extends to the method of reproduction as well. Just as in vitro fertilization can be used to assist couples in having children, they feel that cloning should be used to do the same. For it was decided in the case of l (1972) that "if the eans anything, it is lividual, married or n unwarranted gov- to matters so funda- rson as the decision a child."[15]

ame time, there are isolated cases in hich cloning is being considered the only means of producing biological offspring, such as couples with lethal diseases who do not want to pass the dise on to their chilen, or homosexuals do not want to use m from unknown en via in vitro fertilization. Because of its ability to produce biological offspring, some people would consider cloning more appealing an adoption.[16]

cience has come a way since the time son and Crick charized the double helical structure of DNA. While in the past cloning technology was embedded in the plots of science fiction, today it is a reality. Cloning remains a highly debated topic, shining under the spotlight of scientists, humanitarians, bioethicists, and religious leaders. On the ethical side, there are many seemingly rational ethical reasons to both support and oppose this form of reproduction. As the UK recently announced the allowance of limited cloning of human embryos for research, the world ponders about the fate of human cloning whose future remains a mystery.

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