Cloning, Embryonic Stem Cell Research, and an Approach to Bioethics

Table of Contents

1. INTRODUCTION

The possibility of human cloning entered the public's consciousness as never before by the successful cloning of Dolly the sheep by Ian Wilmut and his team at Roslin Institute in Scotland in 1996. This raises a number of controversial ethical and moral issues, which Free Methodists may need to struggle with now and in the future. Among the most important issues is the use of human embryos for embryonic stem cell research. This paper will outline the types of cloning and the ethical issues that arise and provide guidelines for the Free Methodist Church in Canada to use in approaching these dilemmas.

There are many dimensions to this topic. The science of genetics has been expanding rapidly; first with the discovery of DNA by Watson and Crick in the 70s, then with genetic engineering, and now with the potential for cloning (both reproductive and therapeutic). The "Human Genome Project" succeeded in sequencing the entire human genome (genetic material) in 2003 and made this information available to all serious scientists. Now the potential exists to identify all of the approximately 20,000 genes that make us who we are. And modify them! The ability to tinker with the very "blueprint of life" has raised many ethical issues, which do not seem to be addressed explicitly in scripture. What are the issues? What are the principles we can use in approaching these ethical dilemmas?

2. WHAT IS CLONING?

Strictly speaking, *cloning is the production of an identical genetic replica*. There are three basic types of cloning: (1) DNA/Gene Cloning, (2), Reproductive Cloning and (3) Therapeutic Cloning.

(1) **DNA/Gene Cloning** is also known as "recombinant DNA technology". Each cell has the machinery to make molecules that perform the functions of the cell. Genes are pieces of DNA found on the chromosomes in the nucleus (brain centre) of the cell. These genes contain the instructions that tell the cell machinery what molecules to make. If a gene is defective the cell may be unable to make a certain molecule or it may make the wrong molecule.

    Gene cloning is the production of multiple copies of a gene. The method is to incorporate the gene of interest into a 'cloning vector', usually portions of DNA in bacteria (called plasmids) or non-pathological viruses, which reproduce very quickly. The resulting copies of the gene can be isolated and used for research or therapy.

    This type of cloning raises few ethical concerns and will not be discussed further here.

(2) **Reproductive cloning** is a technology used to generate an animal with the same nuclear DNA as a currently or previously existing animal.

To understand reproductive cloning, a basic understanding of normal reproduction is required. Human reproduction requires an egg from the female and sperm from the male. The female has contained in her ovary a lifetime supply of eggs of which one is prepared each month for release into the fallopian tubes (ovulation) for possible fertilization. Hormones are released which prepare the uterine lining (endometrium) for possible implantation of a fertilized egg. If sperm enters the female reproductive system within a few days of ovulation the sperm migrate up the fallopian tubes and come in contact with the egg. If the sperm is successful in fertilizing the egg then this is what is referred to as 'conception'. Now the egg and sperm together have the genetic material of both parents. The egg and the sperm are special cells which have been produced by a process called 'meiosis' where each contains only 23 chromosomes (instead of the 46 present in all the other cells of the body) so now the fertilized egg (the 'conceptus') contains the full 46 chromosomes (half from each parent). The cell machinery begins a process of cell division that results in a doubling of the cells approximately each day. At 5 - 7 days after conception a 'blastocyst' is formed which is made up of 64-128 cells with some cells on the outer surface and others on the inner surface. This level of development is very important because the inner cells are referred to as 'embryonic stem cells' (ESC) that have the potential to become any cell type in the human body. The outer lining of blastocyst allows for implantation of the developing embryo into the lining of the uterus (6-9 days post-conception).

Normal reproduction is not cloning because half of the DNA comes from each parent thus producing offspring that is uniquely different from each parent. The natural process of cloning is the early division and separation of the fertilized egg that results in identical twins. This process occurs before 14 days post-conception.

The process that produced Dolly the sheep was innovative not only because it produced a living clone, but also because it used DNA from an adult cell from the udder (mammary gland) of a six-year-old Finn-Dorsett sheep. Around that time it was commonly felt that nuclear DNA from embryonic stem cells was needed to produce a clone because only these undifferentiated cells contained the programming needed to become all the cells of the body. It was thought that once adult cells (i.e. an udder cell) were programmed to behave in a certain way (had certain genes turned on, others turned off) they could not go back and behave like stem cells.

Ian Wilmut and his team used a process called Somatic Cell Nuclear Transfer (SCNT) to produce Dolly. An egg from an ewe was obtained at a time she would normally be mating and its nucleus (containing the genetic material) was removed. The nucleus of the cell of the udder of a mature ewe (donor cell) was then injected into the enucleated egg and low voltage electric shocks stimulated cell division. Once cell division begins it does not continue indefinitely in the lab but after a few days the 'embryo' must be implanted in the uterus of a ewe who is hormonally prepared for pregnancy. In the case of Dolly, she was implanted in the uterus of a Scottish Blackface sheep.

The success of this procedure proves that genetic material in adult cells can be induced to revert to a primitive undifferentiated form (stem cell) which is flexible enough to produce all the cells types required for a complete organism, a sheep, in the case of Dolly. Cloning is a form of asexual reproduction that does not require sperm to fertilize the egg. DNA from a donor cell could be a male or a female (in other words, males or females could be cloned) however only females (a uterus is needed in which to implant the embryo) are required for the process.

In reality, these 'cloning' procedures do not actually produce an organism that is an identical clone even though the nuclear DNA is identical. Cells contain small amounts of DNA outside of the nucleus in small organelles called mitochondria. Mitochondria are the power sources of the cell and influence aging. The enucleated egg contributes some mitochondrial DNA to the new organism, which means that although most of the DNA in the 'clone' is from the donor cell, there is some from the mitochondria of the egg. The significance of this is not entirely clear.

(3) **Therapeutic Cloning** is also called 'embryo cloning'. This type of cloning produces embryos for use in research. The goal is to harvest embryonic stem cells (ESC) that can be used to study development and possibly treat disease. When a human embryo is used this obviously raises many ethical issues. Stem cells are extracted after it has developed to the blastocyst stage (5-7 days). These cells are important because they can be used to generate virtually any type of specialized cell in the human body. Many researchers have raised hopes that one day stem cells may be used to treat many diseases such as heart disease (by replacing damaged heart tissue), and Alzheimer's disease (by replacing damaged brain tissue).

Unfortunately the extraction of stem cells from the blastocyst destroys the developing embryo. This again raises the issue of the *moral status*[1] of the human embryo. As Christians, we have faced many of these issues in the ongoing debate over therapeutic abortion and in vitro fertilization (IVF). Most of the embryos used for ESC research in the USA are those left over after IVF procedures. The current method of IVF used in fertility clinics around the world involves the administration of fertility drugs (hormones) to a woman and collecting multiple eggs. These are fertilized in the lab using the husband's/male partner's sperm and a large number of fertilized eggs are allowed to develop to the early embryo stage. Those embryos, which are not used, are frozen in case the couple wishes to try for further children. Once the couple is no longer planning any more children they have the option of donating their left over embryos for research. If not, the frozen embryos are thrown out. If the couple chooses to keep the embryos frozen indefinitely, they will degenerate eventually to become non-viable. Over 400,000 frozen embryos are presently in clinic tanks in the USA, left over from IVF treatments.

[1] By '*moral status*' we mean the status of the embryo which determines the morality of human actions with respect to the embryo.

The following issues arise with the cloning of mammals: (1) Can we clone humans? (2) Should we clone humans?

The following issues arise with the use of embryonic stem cells for research: (1) what is the *moral status* of the embryo? (2) Should we support ESC research? (3) If therapies using this technology become available, should we use them?

3. HUMAN CLONING

1) **Can we clone humans?**

Despite claims of certain unreliable sources, human cloning has not been accomplished. Some scientists do not believe that it can be done. The first cloning of animals was done with amphibians that have large eggs that are relatively easy to manipulate. Among mammals mice, sheep, cattle, pigs and goats have all been cloned. The cloning of these mammals is a very inefficient process compared to sexual reproduction. Each step is complex and fraught with difficulties: extracting eggs, removing the nucleus, transferring the nucleus of the donor cell, stimulating cell division, growing the embryo to the implantable stage, implanting the embryo in the uterus of a female, having the embryo/fetus survive to term and having a live healthy baby born. Each species seems to present a special set of problems. Thus far efforts to clone primates have failed. Using Dolly the sheep, the first mammal to be cloned from an adult cell, as an example; this was the result of years of effort and the combined expertise of many scientists and technicians. 29 embryos were produced from 277 udder cells. Of these implanted embryos only Dolly survived to be born. Animal clones often die in utero or are born with defects. There are concerns about premature aging and susceptibility to disease in clones. Dolly's development of an unusual arthritis and her death at a relatively young 6 years of age (of pulmonary adenomatosis) does nothing to reassure us about the safety of cloning.

Despite these difficulties it is likely that with enough time, resources and the use of ESC for research an artificially cloned human baby could eventually be born. However, the cost would be unacceptably high (destroyed embryos, lost fetuses, deformed or diseased clones, mental anguish and suffering of women carrying the clones, as well as scientists' time and government or corporation money better used elsewhere), and the benefits (production of cloned humans) insufficient.

2) **Should We Clone Humans?**

What possible reasons exist to clone humans? Purely selfish motives such as having a younger copy of you can be easily discounted as unethical. Science-fiction literature or movies often offer insight into the dangers of new technologies. For instance, the 2005 movie "The Island" tells the story of people cloned for the ultimate use of their organs. They were considered "insurance policies", not people. This would be clearly unethical. Even if the motive is the cloning of an especially talented or influential person for the betterment of mankind, or a lost loved one, this can be considered unethical. Human

development is the combination of genetics and environment. Even the perfect genetic clone (a twin) will not be the same as the person cloned. And the enormous pressure on this person to live up to his famous "original" might be intolerable. It is difficult for many adopted children to face their reality. What about a clone?

Although we could argue that with care and proper legislation our society could avoid the 'unethical' use of human cloning, it is certain that *at this time there is no acceptable reason to produce human clones.*

The clone would be a distinct and unique individual in God's eyes. Concerns about a clone being an individual without a soul are not valid. If, despite our best efforts, cloned humans came into existence they would have the same God-given value as you and I.

4. EMBRYO RESEARCH

(1) What is the Moral Status of the Embryo?

Although for many on either side of the debate this question has an obvious answer, it is wise to go through the basic arguments. Following is the list of important landmarks in the life of an embryo:

0	Conception
6-9 days	Implantation
14-16 days	Individualization: Primitive streak forms, can no longer twin
28 days	Formation: heart beat, circulation, neural structures formed
40 days	"formed": Orthodox Jewish, Muslim thought, Thomas Aquinas (90 days for girls) – early Roman Catholic
17+ weeks	Quickening
24 weeks	Viability
36-41 weeks	Birth

A. Life Begins at Conception

Many Christians believe that life begins at conception and that all the value that would be placed on any human being is due to the conceptus. Free Methodists are among those who support this position, in principle, as can be seen by our position on abortion stated in the Manual as follows: "*The intentional abortion of a person's life, from conception on, must be judged to be a violation of God's command, "You shall not commit murder," except when extreme circumstances require the termination of a pregnancy to save the life of the pregnant woman. Induced abortion is the intentional destruction of a person after conception and before delivery by surgical or other means. Therefore, induced abortion is morally unjustifiable except when the act has been decided upon by responsible and competent persons, including Christian professional counsel, for the purpose of saving the life of a pregnant woman. Abortion, when it serves the ends of population or birth control, personal preference or convenience, and social or economic security, must be considered as selfish and malicious.*"[2]

[2] The Manual, The Free Methodist Church in Canada, Ch. 6, pp. 14, 15

From conception the conceptus, if allowed to develop normally, has the capacity to produce a live human being. Although implantation may not occur or spontaneous miscarriage may occur the primary, God-given purpose of the fertilization of an egg is to produce a human being.

The natural extension of this principle would be that the deliberate destruction of an embryo is equivalent to murder. In the case of abortion, the exception is when it is required "*to save the life of the pregnant woman*" or "*when the act has been decided upon by responsible and competent persons, including Christian professional counsel for the purpose of saving the life of a pregnant woman.*"[2]

The value of the embryo is evident in scripture even if scripture is not explicit about some of the finer points of the debate[3]. Psalm 139:13 states: "For You formed my inward parts; You covered me in my mother's womb." God knows us even before we are conceived, values us in the womb and established punishment if a fetus is harmed as if that life was a person.

Consequences in the Law

Ex. 21:22-3 "If men fight and hurt a women with child, so that she gives birth prematurely, yet no harm follows, he shall surely be punished accordingly as the woman's husband imposes on him; and he shall pay as the judges determine. But if any harm follows, then you shall give life for life,…"

This punishment could be interpreted as being only for a 'formed' fetus and it is the time that the embryo/fetus is considered 'formed' that establishes much of the remainder of the debate.

B. Life from conception to Individualization (14 days) has some value, but personhood does not occur until at or after Individualization

Approximately half of all fertilized eggs never implant which means that if full moral status is accorded to the conceptus, huge numbers of lives are being lost through the natural reproductive process. Also, one quarter of pregnancies result in miscarriage. Individualization can occur at 14 days at the earliest. At this time, the precursor to the nervous system (the 'Primitive Streak') is present and the embryo can no longer become twins (2 individuals instead of 1). Many would argue that the nervous system is necessary to produce the mind without which personhood does not exist. It is argued that a graded value should be accorded to the embryo throughout its development. The benefits of embryo research, which has widespread support in the scientific community, include the improvement in our understanding of development. Supporters would claim that the use of ESC will allow advances to be made relatively quickly because these cells have the most potential and flexibility to uncover answers to developmental questions. If

[3] Consider these Scripture references: Psalm 139:13, Isaiah 44:2, Jeremiah 1:5, Job 10:10-11, Job 31:15, Exodus 21:22-3

developmental questions are answered quickly we may also shorten the time in which ESC are required or perhaps methods of harvesting ESC without destroying the blastocyst may be perfected. Use of ESC should allow earlier discovery of treatments for severe diseases such as Parkinson's Disease, Alzheimer's Disease, Diabetes Mellitus, Heart Disease and many others. Another common argument for use of ESC is that hundreds of thousands of frozen embryos are available from IVF clinics and if not used for research they will be simply thrown away. These embryos will never be implanted and will, therefore, never have the possibility of life.

Combining these arguments leads to a position that in some instances an embryo, especially one that will be thrown out anyways, can be sacrificed if the potential future benefit to a sick person can be demonstrated.

C. Personhood Begins at Formation (28 days)

This time of personhood changes very little in the debate except moving the concept of 'formed' life a little farther along in development. Many people have little difficulty considering a blastocyst just a "clump of human cells" but, when the embryo has the basic shape of a infant, a beating heart and the basics of a brain and nervous system then many feel that the line should be drawn. It is probably reasonable to combine the previous two categories together – *Personhood begins sometime between 14 and 28 days*.

D. Personhood Begins at 40 days

Orthodox Jews have developed a consensus, based on their understanding of scripture and their tradition that human life should be protected beginning forty days after conception. Similarly, in Islam, the Koran states that a person is first present forty days after fertilization. In Christianity, early church teachers distinguished between 'formed' and 'unformed'. Thomas Aquinas determined that 'formed' life began at 40 days gestation for males and 90 days for females. This was apparently based on his understanding of the ancient wisdom of Aristotle and his own understanding of the available guidance of scripture. This established Roman Catholic Tradition until modern times when it was determined that "The human being is to be respected and treated as a person from the moment of conception…his rights as a person…among which…is the inviolable right of every innocent human being to life."[4] The Orthodox Church and many Protestant denominations hold a view similar to that of the modern Roman Catholic view.

E. Personhood Begins at Viability

Even those who feel that the embryo has no moral status in earlier states of development will concede that the fetus has the same value as a full term infant if it will survive being out of the womb. Although this time is fluid (some babies will survive if born before 24 weeks, and certainly not all will survive even if born after

[4] God and the Embryo, Religious Voices on Stem Cells and Cloning, Editors: Waters and Cole-Turner, 2003, Appendix A, pg. 168

24 weeks) it seems to be the accepted point after which even secular institutions will prohibit therapeutic abortions except in exceptional cases.

F. Personhood Begins at Birth

That a person is present at birth is beyond reasonable debate. In fact, a startling turnabout occurs in many non-Christian's thinking. The fetus, which is treated as sub-human, through the birth process becomes the most precious form of humanity. The priorities are now reversed. The least developed become the most valued and those who have lived life (the elderly) become least valued. Now potential becomes the pinnacle of value instead of an impediment to personhood.

Christians also value infants and children most highly because of Christ's example and the Scripture's teaching, as well as our 'Natural' instincts to care for and nurture children.

G. Our Position

Our position is that the point at which our moral responsibility begins for a life is at conception whether or not we say that the conceptus is a 'person'. Those lives lost through the normal process of reproduction are in God's hands and our responsibility is only to avoid causing, through our own actions, an excess loss. This is why birth control methods such as IUDs (which prevent implantation after conception) and the 'morning after pill' are morally questionable. It is understood that the issue of birth control is very complex and we live in a sinful world. We are forced to make difficult ethical decisions, many which do not seem to have a right answer, on an individual basis. However, The principle of the value of human life is clear from scripture (Gen. 1:26,27, Romans 5:8). Our responsibility as Christians and human beings is to protect, not exploit, those who are least able to protect themselves. Who is more vulnerable than the embryo? In *The Manual of The Free Methodist Church in Canada* the Law of Life and Love states: "…All people as created by Him and in His image have the same inherent rights regardless of sex, race, or colour. All should therefore give God absolute obedience in their individual, social, and political acts. They should strive to secure to everyone respect for their person, their rights, and their greatest happiness in the possession and exercise of the right within the moral law."[5] We could even add "state of development" to those people who have the same inherent rights and deserve respect. The act of giving your life for another is noble, however the act of taking another's life, even for a noble cause (future possible healing) is not supportable.

The presence of the mind, or self-awareness as evidence of personhood seems to make a lot of sense. However, we would accord value to severely mentally disabled or demented people who may have limited or no self-awareness. Although it is true that there may be a graded moral value during development (i.e. you would save a

[5] The Manual, The Free Methodist Church in Canada, Ch. 1, pg. 4

baby from a fire in a lab before a rack of test tubes containing embryos), this value exceeds the benefits that might be accrued from destroying the embryonic life.

The argument of excess embryos speaks loudly against the questionable morality of the way IVF clinics operate even though this has become widely accepted by society. Acceptance by society at large doesn't constitute a morally acceptable process, in God's eyes. This raises a related issue of who has the 'right' to have children. One particularly influential secular ethicist believes it is a basic human right to reproduce. We would disagree.

Advances in the use of Adult stem cells (ASC) are promising and avoid the ethical concerns that result from ESC research. These cells are partly differentiated but still retain a great deal of flexibility. Adult stem cells are hematologic (form blood cells), neural (brain and nervous system cells) and mesenchymal (form cartilage, bone and muscle cells). Some proposed treatments using ESC, such as repairing tissue in a damaged heart, would require anti-rejection therapy life long. These ASC could avoid the necessity of this lifelong anti-rejection therapy if the stem cells are harvested from the patient and then modified to perform the required function. Stem cells can also be isolated from umbilical cord blood of newborns. Progress on understanding development and differentiation of cells and developing cures or treatments for terrible diseases may (or may not) be slower than if ESC research is allowed to proceed.

(2) Should We Support Embryonic Stem Cell Research?

Life begins at conception. All life is sacred because we are all made in the image of God. Even if the blastocyst is of lesser moral value than a more developed fetus, its value still exceeds value of the purposes for which it is being used. Healing is a noble and laudable cause but we should not do evil to produce good (Romans 3:7, 8). The ends do not justify the means. At this time the benefits that may arise from ESC research seem vast but progress is in its infancy. Supporters of ESC research claim, with cause, that progress will be slowed (or stopped) if research is halted. However, *we cannot condone the destruction of the embryo* that is required to harvest embryonic stem cells.

(3) If therapies using this technology become available, should we use them?

Not accepting treatment will not save the life of the sacrificed embryo. It may in fact, give value to the sacrifice of the embryo. *The decision to take this treatment will have to be made with much prayer and seeking of God's will and Christian professional counsel.*

5. PRINCIPLES

1. Humans are valuable because they were created in the Image of God, and despite our sin, Christ died for us.

2. God loves us even before we were born. Humans have value in the womb, at all stages of development.

3. Although pregnant woman's life may, in certain instances, take precedence over embryo's life, and it is possible that there is a graded moral value according to stage of development, only God can judge the appropriate level of precedence. Therefore, from our perspective as creatures, all developing human life has such high value that, in other than exceptional cases, we should be consider all human life, from conception on, to be equal in value.

4. Christian behaviour should be to protect those who cannot protect themselves, including embryos.

5. Doing evil so that good can occur is contrary to explicit scriptural command. The non-voluntary sacrifice of a life, including an embryo, for the benefit of another cannot be supported.

6. Parental consent for the use of frozen embryos for research, although legally acceptable, may be morally unacceptable if the parents fail in their duty to observe the best interests of the embryo.

7. Each human is an individual. If a human is a genetic clone of another individual he/she is still a unique individual and is entitled to all the rights of anyone else.

8. There is no innate right of humans to reproduce, without looking at the consequences of the methods used to allow reproduction.

6. FINAL COMMENTS

New Scientific breakthroughs, especially those in the field of genetics provide challenges to us as Free Methodists and Christians. The ethical issues that arise lead to controversy and strong emotional responses. We need to make the best decision we can with the knowledge that we have at this time. We do this prayerfully and humbly and with our spirits open to God's guidance. Where we do not have explicit instructions in scripture we must err on the side of caution, particularly when lives are at stake. New information or technological advances may require our re-evaluation of our position.

7. REFERENCES

The Manual of The Free Methodist Church in Canada

After Dolly, The Uses and Misuses of Human Cloning, Ian Wilmut & Roger Highfield, 2006, W. W. Norton & Company Ltd.

God and the Embryo, Religious Voices on Stem Cells and Cloning, Editors: Brent Waters and Ronald Cole-Turner, 2003, Georgetown University Press.

Human Cloning, Religious Responses, Editor: Ronald Cole-Turner, 1997, Westminster John Knox Press.

Gibbs, Nancy, Stem Cells, The Hope and the Hype, *Time*, August 7, 2006, pp.27-32

http://www.ornl.gov/sci/techresources/Human_Genome/home.shtml

http://www.aaas.org/spp/cstc/briefs/cloning/

http://www.genome.gov/10004765

http://learn.genetics.utah.edu/units/cloning/clissues/