"As things are, there is no reason to assume that anything we might reasonably conceive of doing with living tissues might not be possible; living tissues are proving to be remarkably compliant . . . [We] can look forward to an age in which the understanding of life’s mechanisms will be virtually total, that is, the principal systems will be understood molecule by molecule. From this total understanding will come - if we choose - total control. Of course the word 'total' is too absolute. There will always be deficiencies and inconsistencies. Biology will never come to an end. But for all practical purposes we might as well assume that absolute control will be possible. It is not irresponsible - nor, indeed, sensationalist - to suggest this. It is irresponsible to imply the opposite, that our power will always be too limited to worry about. We are entering the age of biological control, and we should gird our moral and political loins accordingly."

The above quote from Ian Wilmut, the man who captured the world's attention with his creation of Dolly, the cloned sheep, should awaken us all to the vast power of the scientific community, as well as to the desire for total control held by so many scientists in this post-modern era.

Given the spin that science and the media have put on the latest achievement in medical science - the cloning of the first human embryo - some reading this article may truly believe that there are good, and even therapeutic, reasons for human cloning and that human cloning cannot really result in the development of a human being to the point of birth. This article is intended to help Christians gain an understanding of what therapeutic cloning really is and how it may be used to treat disease, as well as to equip them to evaluate their position on this issue by providing them with both an understanding of the science and the truths of Scripture as they relate to this technology.

First, there is absolutely no difference in the scientific techniques used to accomplish - or the embryonic human beings produced - via therapeutic cloning or the cloning of a human being for other purposes. The idea that an "organism" created by cloning is a "new type of biological entity never before seen in nature" is an attempt by scientists to hide the truth of this new technology behind scientific jargon. Instead of calling this cloned organism an embryo, which is precisely what it is, scientists have labeled it an "activated egg." This is again manipulation of terminology with the hope of deceiving the public. In fact, the term "therapeutic cloning" itself
is used to deceive the general public into believing that human cloning is acceptable and beneficial in certain medical circumstances. With the media's and the scientific community's frequent misuse of scientific terminology, it is crucial that we as Christians correctly discern the meanings behind this terminology. If we do not take steps to understand the science, we cannot defend our position in an educated manner and therefore will have no public voice on these issues.

All human cloning, whether "therapeutic" or not, is done in the following manner. First, scientists take DNA (deoxyribonucleic acid - the genetic material of most organisms) from any cell in the body that is not a germ cell (sperm or egg). The cells the DNA is taken from are called somatic cells. Somatic cells contain two copies of each of the genes that make up a person's DNA (diploid), while germ cells contain only one copy of each of the genes of a person's DNA (haploid). Diploid DNA from a somatic cell is then inserted into a human egg cell which has had its own DNA removed (enucleated). This process is known as somatic cell nuclear transfer (SCNT), because the nucleus of the somatic cell containing the diploid DNA has been transferred to an egg that has no nucleus. At the point of transfer, the egg becomes diploid, meaning it now contains two copies of the DNA necessary to code for a human being. It is now an embryo. (Figure 1)

Fig 1

![Image not found](http://www.bioethix.net/resources/images/coxon-fig1.gif)

Figure 1. Process of cloning by somatic cell nuclear transfer.

At this point, the question may be raised as to how an embryo is created without a sperm uniting with the egg. In the normal process of fertilization and embryo formation, the egg and sperm cells each have only one copy, or half, of the DNA necessary to code for a fully functioning human being. Each of these cells is haploid. When the sperm and egg unite, they form a cell with two copies of the total DNA necessary for a human being to develop (diploid). At the point of union of the sperm and egg, an embryo is created. (Figure 2) The definition of fertilization is "the process of union of two gametes whereby the somatic chromosome number is restored and the development of a new individual is initiated." Scientifically speaking, then, the development of a new individual is initiated at the point of fertilization, when the somatic chromosome number is restored, thereby making a diploid fertilized egg (embryo).
Figure 2. Natural process of fertilization: the egg contributes one copy of DNA and the sperm contributes one copy of DNA to form a diploid (two copies of DNA) embryo. 

As you can see by comparing the science, both "therapeutic" cloning and normal fertilization result in the production of an embryo. In the process of "therapeutic" cloning, the transfer of diploid DNA from a somatic cell into an enucleated egg results in the egg cell being made diploid (becoming an embryo) and the initiation of the development of a human being. In the process of fertilization occurring between an egg and a sperm, the egg is haploid (one copy of the DNA) and the sperm is haploid (one copy of the total DNA). The union of the egg and sperm forms a diploid cell, the embryo, which then divides en route to becoming a fully developed human being. In order for a normal human being to develop, an embryo must be diploid or contain two copies of each chromosome. In the cases of "therapeutic" cloning and natural fertilization, a diploid embryo is created so that "the somatic chromosome number is restored and the development of a new individual is initiated". (Figure 3)
Figure 3. Comparison of cloning and natural fertilization. In both cases, the result is a human embryo, the earliest form of human life.

Scientists have made claims that an "organism" created by cloning is not human. In fact, members of Advanced Cell Technology's ethics advisory board have stated that, "Although it [a cloned human embryo] possesses some potential for developing into a full human being . . . it has no organs, it cannot possibly think or feel, and it has none of the attributes thought of as human." However, these statements are also equally true of a naturally created embryo in its earliest stages, which we know to be human. Indeed, it is well-known and well-documented in the scientific literature that cloned embryos of other species that are transferred at the embryo stage into the womb of a female and survive to birth are born as animals of the species to which they belong. That is to say, cloned mice have been born as mice, sheep as sheep, goats as goats, cattle as cattle, and pigs as pigs - not as "a new type of biological entity never before seen in nature." So, while scientists claim that the entity cloned from a human is "not really human," we can be certain that these claims are wrong based on recent cloning experiments with other species which have resulted in the birth of organisms of the same species from which they were cloned.

"Therapeutic" cloning, then, results in the creation of a human being. Scientists do not want to recognize this fact because recognizing these clones as humans would create more problems in using embryonic human clones for research purposes. At this point, "therapeutic" cloning of humans has failed to produce the coveted embryonic stem cells for use in research because, although scientists have claimed to clone the first human being, that human being died at the six-cell stage. In order to use cloned embryos for "therapeutic" purposes, they must live to about day six, when they contain hundreds of cells. However, if scientists are able to extend the survival of these cloned human beings, their stem cells could be obtained via the same destructive process used to obtain stem cells from "surplus" embryos created via in vitro fertilization (IVF). In both cases, the embryo is destroyed in culture at about day six following fertilization or cloning. At this stage, called the blastocyst stage (the stage just prior to the point of natural implantation in the womb), the embryo consists of a
trophoblast (outer layer of cells which form the placenta) that surrounds the inner cell mass, which contains the pluripotent stem cells that have the potential to develop into any part of the human being. (Figure 4)\(^6\)

Fig 4

Figure 4. Human embryo at the blastocyst stage. It is at this stage that embryonic stem cells are harvested for research purposes.

After the embryo is destroyed and the stem cells have been harvested, these cells are grown in the laboratory. In theory, the cells can be induced to develop into any tissue needed to treat or cure a specific disease. However, the actual treatment of disease using embryonic stem cells is, as yet, a promise without much proof from the scientific community. Furthermore, even if embryonic stem cell research does produce treatments or cures, the term "therapeutic cloning" is nevertheless an oxymoron in that its practice would result not in therapeutic gain, but loss of life, for the embryos from whom such cells are derived.

What should Christians think about "therapeutic" cloning, and how should they respond to such technological "advancements"? First, they must acquire an understanding of the world view behind these new technologies. A basic humanistic, utilitarian worldview advocates choosing the course of action that promises to achieve the greatest amount of value.\(^7\) If one follows the language used in the debates on both cloning and embryonic stem cell research, the utilitarian worldview is very apparent. Robert Lanza, vice president of medical and scientific development at Advanced Cell Technology, stated in a news release which was later printed in the Washington Post, "Our intention is not to create cloned human beings, but rather to make life-saving therapies for a wide range of human disease conditions, including diabetes, strokes, cancer, AIDS, and neurodegenerative disorders such as Parkinson's and Alzheimer's disease."\(^8\) Similarly, in his statement on embryonic stem cell research, Senator Orrin Hatch (R-Utah) said that, "Stem cell research facilitates life . . . . Abortion destroys life; this is about saving lives . . . . The most pro-life position would be to help people who suffer from these maladies . . . . Why shouldn't we use these cells to benefit mankind?"\(^9\) These are only two of the many examples of the pervasiveness of the utilitarian worldview among those who promote this research. As Christians, we must realize that people who believe that human beings evolved from animals and who do not have a personal relationship with God often base their positions on issues such as cloning in the desire to cure disease at almost any cost, the desire to obtain more knowledge, or the desire to be "first" in a particular scientific achievement. Unfortunately, they lack the understanding that all life - even in its most innocent and earliest form -- is a gift from God, created in His image and designed to carry out His purposes.
Second, I believe that Christians need to possess a fundamental understanding of how they are to interact with the world and how Scripture applies to these issues. In Matthew 5:13, we are called to be the "salt of the earth." 10 As that salt, we cannot only be hungry for God's truth, but must also be willing to share that truth with a lost and dying world. In Matthew 10:16, when the disciples were sent to minister in the cities, they were told to "be as shrewd as snakes and as innocent as doves."11 We need to follow this example and strive to be wise in our dealings with unbelievers, as well as to always "speak the truth in love" (Ephesians 4:16) to them. It is crucial that we realize that God is sovereign in these matters, that He allows all things for a purpose, and that only He can change people's hearts. However, this cannot be an excuse to ignore the current issues and refuse to speak out when necessary on these matters. Indeed, in Matthew 22:22, we are not called just to "love the Lord our God with all our hearts and souls" but also with our minds.12 The church for so long has lived in an "anti-intellectual" state of existence. However, Christians cannot go on thinking that bioethical issues will take care of themselves. We must begin grappling very seriously with these issues, or we will be taken by surprise and shock when our tax dollars begin being used to pay for atrocities that our post-modern society calls "technology."

Scripture teaches that all human life is created in God's image. Genesis 1:26-27 states "Then God said, 'Let us make man in our image, in our likeness' ... So God created man in his own image, in the image of God he created him; male and female he created them."13 The fact that human beings are created in God's image is repeated throughout Scripture and gives us our innate value. Our value, then, does not come from our contributions to society, as the humanistic world view touts, but rather from our identity as creatures created in the image of our loving God. What does God say about the destruction of human life, all of which bears His image? Genesis 9:6 states "Whoever sheds the blood of man by man shall his blood be shed; for in the image of God has God made man."14 Here we can clearly see that the punishment for destroying human life is death, and the reason for this severe penalty is because that life was created in God's image. Finally, when looking at the life of the unborn, we cannot ignore Psalm 139:13-16, which states, "For you created my inmost being; you knit me together in my mother's womb. I praise you because I am fearfully and wonderfully made; your works are wonderful, I know that full well. My frame was not hidden from you when I was made in the secret place. When I was woven together in the depths of the earth, your eyes saw my unformed body. All the days ordained for me were written in your book before one of them came to be."15 As Christians, we know that embryos are living human beings who have innate value given by our awesome and sovereign God. In light of this, we can do no less than to stand against technologies that necessitate the destruction of embryonic human life.


9 Ibid.


11 Ibid.

12 Ibid.

13 Ibid.

14 Ibid.

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