

Genetic Engineering – A Christian Scientist's Perspective

Dr. Ray Bohlin examines the rapidly moving world of genetic engineering from a Christian worldview perspective. He explains that most genetic engineering attempts to make more efficient changes similar to those previously done through selective breeding and other conventional techniques. However, those working in the field need to be aware of the ethical and religious issues that arise in this area of science.

What Is Genetic Engineering?

Our culture teeters on the edge of a steep and dangerous precipice. New technologies will soon allow us to change, radically and permanently, the world in which we live. Indeed, we will hold in our hands the capability of directly and purposefully changing who we are as human beings. The technology I am speaking of is genetic engineering.[\[1\]](#) Ethical and technical questions swirl around discussions of genetic engineering like the wall clouds of the eye of a hurricane. Many in society seem to be bracing themselves for the disappearance of the calm of the eye and the coming of the full force of a powerful and destructive combination of new plants and animals unleashed on an unsuspecting environment, with new and improved humans designed to succeed.

Before your alarm buttons go on overload, let me say that I hope to lend a reassuring voice with a dose of sober realism. Genetic technology will undoubtedly unleash great power to change our world forever, but should it, and will it? In this article I want to explore just a few of the technical and ethical questions we face as a society. The time to discuss

these issues is now, while we still have time to think without simply reacting.

The phrase *genetic engineering*, unfortunately, often conjures up images of macabre experiments resulting in Frankenstein-like monsters and the cold-hearted use of genetic information to create new social classes depending on our genes, as in the 1997 film *Gattaca*.^{2} However, genetic engineering can simply be defined as the manipulation or alteration of the genetic structure of a single cell or organism.

Sometimes the manipulation of an organism's genome, the totality of all its genes, can simply refer to the project of identifying its complete DNA sequence in order to gain information for future study and potential alteration. The Human Genome Project is therefore, in a sense, a form of genetic engineering because the human genome must be broken up and manipulated in order to gain the desired information.

Ordinarily, genetic engineering refers to the direct addition, deletion, or intentional mutation of an organism's DNA sequence to produce a desired effect. Knockout experiments in mice seek to determine the effects of eliminating a particular gene from the mouse genome. Recombinant DNA experiments usually take a gene found in one organism and place the gene into another organism. These animals can be of the same or different species.

Sometimes researchers will simply change the DNA sequence in a gene to study what effect the specific change has on the gene or its protein product. All of these alterations fall under the umbrella of genetic engineering. In this broad definition, genetic engineering is neither good nor evil. The nature of the experiments themselves will determine if they are moral or immoral.

Why Are There Genetic Illnesses?

The initial thrust of genetic research is the treatment and potential cure of genetic illnesses. Therefore, we must explore why genetic illnesses occur at all. "Why questions" within science usually occur on two levels and are notoriously difficult. The first level and usually the easier of the two are the scientific. The "why" is best changed to "how." For our purposes this means, How do genetic illnesses arise? The second, more difficult question asks on a moral basis, Why do genetic illnesses occur?

The answer to the first question, How do genetic illnesses arise?, is simply, mutations. Mutations are mistakes in the DNA sequence. Sometimes a mutation is simply the substitution of one nucleotide for another.

Mutations can also result from a piece of DNA being deleted. This may cause one or more codons to disappear. In cystic fibrosis (CF), codon 508 out of 1,480 is missing, causing one amino acid to be removed from the resulting protein. This causes the severe respiratory and digestive problems of CF patients that are usually lethal before their 30th birthday.

So far, genes for more than 1,200 human disorders have been identified, which are found over all twenty-three pairs of human chromosomes. Some estimate that there may be as many as 3,000 to 4,000 human genetic disorders that are due to defects in a single gene. Most disorders, however, will be due to mutations in a host of genes.

The moral question is perhaps not so difficult in its answer, but in our acceptance of the answer. Mutations exist as a result of the Fall. We know the serpent was cursed, Eve was cursed, and Adam was cursed (Gen. 3:14-19). But Romans 8:18-22 also tells us that all creation was subjected to futility, groans and suffers, and eagerly awaits the revealing of the sons of God so it may be set free from its slavery to

corruption. This world is not as God intended.

Asking why someone suffers from a genetic disease is no different than asking why someone was killed in a traffic accident when others walked away. We know our suffering is temporary. We know that God will somehow work it all out for good (Rom. 8:28). But in 2 Corinthians Paul tells us we suffer so we can comfort those who suffer after us (1:4), so other sufferers will know they are not alone (1:6), and, principally, we suffer so we will trust in God and not ourselves (1:9).

Part of the Christian mission has always been to alleviate suffering where possible. While Jesus' miracles clearly were part of fulfilled prophecy, they were also about relief from suffering. Genetic engineering, while possessing a power that can be used for evil, which we will discuss, also at least has the potential to relieve the suffering from, if not even cure, genetic disease.

Could Changing Genetic Material Produce a Dangerous Superbug?

One concern that many people have about genetic engineering is the possibility of unintentionally creating a superbug or a damaging plant or animal whose destructive nature is only discovered after the fact. After all, our knowledge of the workings of genes and proteins is still growing. We hear constantly how complex everything is. What makes us think we can tinker with this incredible biological reservoir of information without making some incredible blunder from which there is no turning back?

When genetic engineering in bacteria was first discovered and introduced (Recombinant DNA technology), many scientists had this very fear. This was partially the reason for the self-imposed moratorium and four levels of containment in the early 1970s. But geneticists and molecular biologists found that

dangerous, unintentional consequences were virtually nonexistent. Enforcement of the guidelines eventually relaxed and soon became outdated and ignored. What this means is that researchers were quite convinced that transferring DNA of known sequence and function into bacterial chromosomes and plasmids did not result in unforeseen consequences. The procedure became routine and straightforward.

This does not mean that someone, somewhere, won't use biotechnology to produce a superbug intentionally. Certainly this technology can be used to produce even more powerful and resistant agents of biological warfare. Some even speculated that HIV (human immunodeficiency virus), the virus that causes AIDS, was intentionally produced. Though this hypothesis has been successfully refuted, the prospect remains that DNA recombinant technology has opened up a new field that can be used for evil.

However, we must be clear that this is not the fault of the technology itself. It is entirely human to shrink with fear away from things that we don't understand. The first predictable reaction of tribal societies when faced with modern technology was to cower in fear. Something dreadful was about to descend upon them. Usually this didn't happen and, with some education and familiarity, fear dissipated. But only human agents alone can make evil choices. Fire will heat our homes and cook our food, but it can also kill indiscriminately in the hands of an arsonist. But fire itself is not evil.

What should concern us more than the advent of biotechnology is the growing popularity of a totally secular and naturalistic worldview. Naturalism contends that humans are just complicated animals. The end result of this assumption is that ethics becomes an exercise in simply determining what works, not what is right.

Biotechnology is powerful, indeed, but we cannot put the genie back in the bottle. Therefore we must engage the discussion as

to how this technology can be used to cure disease and not become another snare to degrade and dehumanize people's lives.

Are We Playing God by Creating Organisms That Never Existed Before?

Unfortunately, the concept of playing God means different things to different people.[\[3\]](#) For some it may have nothing to do with God at all. They are simply expressing awe and wonder at the power that humans can wield over nature.

For some Christians, however, the notion of playing God carries a pietistic view of God's realm of activity versus that of the human race. In this context, playing God means performing tasks that are reserved for God and God alone. If this is what genetic technology does, then the concerns about playing God are justified. But what is often being reflected in this perspective is that God acts where we are ignorant and it should stay that way.

What is really at stake is fear, fear of what we may learn, fear of what new responsibility this new knowledge will put on our shoulders, and fear that this new knowledge will be used to harm us and not for the common good. The point was made that technology itself is not evil. Any technology can be used to further God's purposes or hinder them. People make those decisions, not technology.

By the very fact that we are called to be stewards of God's creation (Gen. 1:26-28), we need to expand our knowledge of what God has made in order to better rule over His creation. Part of being made in God's image is our creativity. In this sense we "play God" by imitating Him. Our works of art, buildings, management of natural parks, and care for the poor, sick, and disadvantaged all imitate God for the good of His creation.

But we are still creating new creatures that did not exist

before. Isn't God the only Creator in that sense? We seldom realize that we are hard-pressed to find in nature today the ancestors of nearly all the plants and animals we use for food or service. Our current varieties of corn, wheat, flowers, cattle, dogs, horses, etc., bear little resemblance to the original stock in nature. That is because we have selected and manipulated them over the millennia for our own purposes. We have already created animals and plants that never existed before. Genetic technology has greatly increased the specificity and power of our abilities, but the nature of what we can do is the same as before.

If we are to play God in the sense of imitating Him as we apply the truth of being created in His image and in exercising our appointment as stewards over all He has made, then we need to do so with humility and compassion. Our creative abilities should be used to enhance the condition of men and women as we struggle in a fallen world. Genetic technologies can and should be used to help alleviate or even cure the effects of genetic disease.

Is It Wrong to Combine Genes from Different Species?

Have you ever wondered if we should be transferring genes from one species to another at all? Does this in itself violate some ethical principle? One gene does not define a species. Bacteria are composed of thousands of genes and it is estimated that humans possess as many as 100,000 genes. Therefore, transferring one gene from one organism to another does not create a hybrid in the traditional sense. Genes, remember, are composed of DNA. DNA is a molecule; it is not living in and of itself.

If the idea of adding something foreign to an organism is troublesome, just realize that we do this all the time when we take antibiotics, over the counter pain medications, and other

synthetic medications. Our bodies would never come across most of these substances in nature.

What is different is that with genetic engineering, we have added something to a cell or organism that will change the composition of that cell or organism, possibly for as long as it lives, and is potentially passed on to future generations. It is reasonable to ask if we have the wisdom even to try to make these kinds of changes. No doubt, genetic technology provides a power never before possessed by human beings: to design intentionally or create a new variety of organism by altering its genetic structure.

Once again, the issues are, Which genes are actually being transferred? and, For what purpose? These questions, asked case by case, should rule our choices, not the inherent legitimacy of genetic engineering itself. Creating crops internally resistant to disease, particularly to help developing countries better feed their people, is a goal worthy of God's image-bearers.

However, intentionally manipulating the gene of a known pathogenic and deadly bacterium with the expressed intent of creating a biological weapon that is untreatable and incurable is a hideous evil. Kerby Anderson also warns that we need to consider the extent that genetic manipulation may cross over barriers God instituted in the created kinds.^{[\[4\]](#)} If God felt it important to create boundaries of reproduction that his creatures were to stay within, we ought not cross over them ourselves (Gen. 1:11, 12, 21, 24, 25).

It is certainly possible for genetically modified organisms created for agricultural and medical purposes to develop in ways not planned or foreseen. Therefore, it is necessary that proper and extensive tests be performed to assure, as much as possible, that no unnecessary harm will come to the environment or to humans. As vague as this prescription is, it only serves to reinforce the necessity of further education on

the part of everyone to ensure that this powerful technology is used responsibly. We simply cannot afford to be ignorant of genetic issues and technologies and expect to contribute to the necessary discussion that lies ahead.

Notes

1. An excellent resource for Christians on this topic is *Genetic Engineering: A Christian Response*, Timothy J. Demy and Gary P. Stewart, eds. (Grand Rapids, MI: Kregel Publications, 1999)
2. *Gattaca*, a film by Andrew Niccol, A Jersey Films production, distributed by Columbia Pictures, 1997.
3. Allen D. Verhey, "Playing God," in *Genetic Ethics: Do the Ends Justify the Genes?* (Grand Rapids, MI: Eerdmans Publ. Co., 1997), 60-74.
4. J. Kerby Anderson, "The Ethics of Genetic Engineering and Artificial Reproduction," in *Genetic Engineering: A Christian Response*, Timothy J. Demy and Gary P. Stewart.

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Technological Challenges of the 21st Century

We live in historic times. And we will face new challenges as we enter the 21st century, especially in the area of technology. The fields of biotechnology and information technology have the capacity to change the social landscape and even alter the way we make ethical decisions. These are not challenges for the faint-hearted. We must bring a tough-minded Christianity into the 21st century.

We are reminded in 1 Chronicles 12:32 (NIV) that the men of Issachar “understood the times and knew what Israel should do.” Likewise, we must understand our times and know what we should do. New ethical challenges await us as we consider the moral issues of our day and begin to analyze them from a biblical perspective.

We should also enter into the task with humility. Over a hundred years ago, Charles Duell, Director of the U.S. Patent Office, was ready to close his office down because he believed that “Everything that can be invented has been invented.”[\[1\]](#) We should not make the mistake of thinking that we can accurately see into the future. However, we can analyze trends and look at new inventions and begin to see the implications of these remarkable changes. Our challenge will always be to apply the timeless truths of Scripture to the quickly changing world around us.

How should Christians analyze the technological changes taking place? First we must begin by developing a theology of technology.

Theology of Technology

Technology is really nothing more than the systematic modification of the environment for human ends. This might be a process or activity that extends or enhances a human function. A telescope extends man’s visual perception. A tractor extends one’s physical ability. A computer extends a person’s ability to calculate.

The biblical mandate for developing and using technology is stated in Genesis 1:28. God gave mankind dominion over the land, and we are obliged to use and manage these resources wisely in serving the Lord. God’s ideal was not to have a world composed exclusively of primitive areas. Before the Fall (Gen. 2:15) Adam was to cultivate and keep the Garden of Eden. After the Fall the same command pertains to the application of

technology to this fallen world, a world that “groans” in travail (Rom. 8:22). Technology can benefit mankind in exercising proper dominion, and thus remove some of the effects of the Fall (such as curing disease, breeding livestock, or growing better crops).

Technology is neither good or evil. The worldview behind the particular technology determines its value. In the Old Testament, technology was used both for good (e.g., the building of the ark, Gen. 6) and for evil (e.g., the building of the Tower of Babel, Gen. 11). Therefore, the focus should not be so much on the technology itself as on the philosophical motivation behind its use. Here are three important principles that should be considered.

First, technology should be seen as a tool, not as an end in itself. There is nothing sacred about technology. Unfortunately, Western culture tends to rely on it more than is appropriate. If a computer, for example, proves a particular point, people have a greater tendency to believe it than if the answer was a well-reasoned conclusion given by a person. If a machine can do the job, employers are prone to mechanize, even if human labor does a better or more creative job. Often our society unconsciously places machines over man. Humans become servants to machines rather than the other way around.

There is a tendency to look to science and engineering to solve problems that really may be due to human sinfulness (wars, prejudice, greed), the fallenness of the world (death, disease), or God’s curse on Adam (finite resources). In Western culture especially, we tend to believe that technology will save us from our problems and thus we use technology as a substitute for God. Christians must not fall into this trap, but instead must exhibit their ultimate dependence on God. Christians must also differentiate between problems that demand a technological solution and ones that can be remedied by a social or spiritual one.

Second, technology should be applied in different ways, according to specific instructions. For example, there are distinctions between man and animal that, because we are created in God's image (Gen. 1:26-27), call for different applications of medical science. Using artificial insemination to improve the genetic fitness of livestock does not justify using it on human beings. Christians should resist the idea that just because we *can* do something, we *should* do it. Technological ability does not grant moral permission.

Third, ethics, rather than technology, must determine the direction of our society. Jacques Ellul has expressed the concern that technology moves society instead of vice versa.[\[2\]](#) Our society today seems all too motivated by a technological imperative in our culture. The technological ability to do something is not the same as a moral imperative to do it. Technology should not determine ethics.

Though scientists may possess the technological ability to be gods, they nevertheless lack the capacity to act like gods. Too often, man has tried to use technology to become God. He uses it to work out his own physical salvation, to enhance his own development, or even to attempt to create life. Christians who take seriously human fallenness will humbly admit that we often do not know enough about God's creation to use technology wisely. The reality of human sinfulness means that society should be careful to prevent the use of technology for greed and exploitation.

Technology's fruits can be both sweet and bitter. C. S. Lewis writes in the *Abolition of Man*, "From this point of view, what we call Man's power over Nature turns out to be power exercised by some men over men with Nature as its instrument. . . . There neither is nor can be any simple increase of power on Man's side. Each new power won *by* man is a power *over* man as well. Each advance leaves him weaker as well as stronger. In every victory, besides being the general who triumphs, he is also the prisoner who follows the triumphal car."[\[3\]](#)

Christians must bring strong biblical critique to each technological advance and analyze its impact. The goal should be to liberate the positive effects of technology while restraining negative effects by setting up appropriate constraints against abuse.

The Challenge of Biotechnology

The age of biotechnology has arrived. For the first time in human history it is possible to completely redesign existing organisms, including man, and to direct the genetic and reproductive constitution of every living thing. Scientists are no longer limited to breeding and cross-pollination. Powerful genetic tools allow us to change genetic structure at the microscopic level and bypass the normal processes of reproduction.

For the first time in human history it is also possible to make multiple copies of any existing organism or of certain sections of its genetic structure. This ability to clone existing organisms or their genes gives scientists a powerful tool to reproduce helpful and useful genetic material within a population.

Scientists are also developing techniques to treat and cure genetic diseases through genetic surgery and genetic therapy. They can already identify genetic sequences that are defective, and soon scientists will be able to replace these defects with properly functioning genes.

Gene splicing (known as recombinant DNA technology) is fundamentally different from other forms of genetic breeding used in the past. Breeding programs work on existing arrays of genetic variability in a species, isolating specific genetic traits through selective breeding. Scientists using gene splicing can essentially “stack” the deck or even produce an entirely new deck of genetic “cards.”

But this powerful ability to change the genetic deck of cards also raises substantial scientific concerns that some “sleight-of-hand” would produce dangerous consequences. Ethan Singer said, “Those who are powerful in society will do the shuffling; their genes will be shuffled in one direction, while the genes of the rest of us will get shuffled in another.”^{4} Also there is the concern that a reshuffled deck of genes might create an Andromeda strain similar to the one envisioned by Michael Crichton in his book by the same title.^{5} A microorganism might inadvertently be given the genetic structure for some pathogen for which there is no antidote or vaccine.

The potential benefits of gene splicing are significant. First, the technology can be used to produce medically important substances. The list of these substances is quite large and would include insulin, interferon, and human growth hormone. The technology also has great application in the field of immunology. In order to protect organisms from viral disease, doctors must inject a killed or attenuated virus. Scientists can use the technology to disable a toxin gene, thus producing a viral substance that triggers production of antibodies without the possibility of producing the disease.

A second benefit is in the field of agriculture. This technology can improve the genetic fitness of various plant species. Basic research using this technology could increase the efficiency of photosynthesis, increase plant resistance (to salinity, to drought, to viruses), and reduce a plant’s demand for nitrogen fertilizer.

Third, gene splicing can aid industrial and environmental processes. Industries that manufacture drugs, plastics, industrial chemicals, vitamins, and cheese will benefit from this technology. Also scientists have begun to develop organisms that can clean up oil spills or toxic wastes.

This last benefit, however, also raises one of the greatest

scientific concerns over the use of biotechnology. The escape (or even intentional release) of a genetically engineered organism might wreak havoc on the environment. Scientists have created microorganisms that dissolve oil spills or reduce frost on plants. Critics of gene splicing fear that radically altered organisms could occupy new ecological niches, destroy existing ecosystems, or drive certain species to extinction.

A significant question is whether life should be patented at all. Most religious leaders say no. A 1995 gathering of religious leaders representing virtually every major religious tradition spoke out against the patenting of genetically engineered substances. They argued that life is the creation of God, not humans, and should not be patented as human inventions.[\[6\]](#)

The broader theological question is *whether* genetic engineering should be used and, if permitted, *how* it should be used. The natural reaction for many in society is to reject new forms of technology because they are dangerous. Christians, however, should take into account God's command to humankind in the cultural mandate (Gen. 1:28). Christians should avoid the reflex reaction that scientists should not tinker with life; instead Christians should consider how this technology should be used responsibly.

One key issue is the worldview behind most scientific research. Modern science rests on an evolutionary assumption. Many scientists assume that life on this planet is the result of millions of years of a chance evolutionary process. Therefore they conclude that intelligent scientists can do a better job of directing the evolutionary process than nature can do by chance. Even evolutionary scientists warn of this potential danger. Ethan Singer believes that scientists will "verify a few predictions, and then gradually forget that knowing something isn't the same as knowing everything. . . . At each stage we will get a little cockier, a little surer we know all the possibilities."[\[7\]](#)

In essence biotechnology gives scientists the tools they have always wanted to drive the evolutionary spiral higher and higher. Julian Huxley looked forward to the day in which scientists could fill the “position of business manager for the cosmic process of evolution.”[\[8\]](#) Certainly this technology enables scientists to create new forms of life and alter existing forms in ways that have been impossible until now.

How should Christians respond? They should humbly acknowledge that God is the sovereign Creator and that man has finite knowledge. Genetic engineering gives scientists the technological ability to be gods, but they lack the wisdom, knowledge, and moral capacity to act like God.

Even evolutionary scientists who deny the existence of God and believe that all life is the result of an impersonal evolutionary process express concern about the potential dangers of this technology. Erwin Chargaff asked, “Have we the right to counteract, irreversibly, the evolutionary wisdom of millions of years, in order to satisfy the ambition and curiosity of a few scientists?”[\[9\]](#) His answer is no. The Christian’s answer should also be the same when we realize that God is the Creator of life. We do not have the right to “rewrite the fifth day of creation.”[\[10\]](#)

What is the place for genetic engineering within a biblical framework? The answer to that question can be found by distinguishing between two types of research. The first could be called genetic repair. This research attempts to remove genetic defects and develop techniques that will provide treatments for existing diseases. Applications would include various forms of genetic therapy and genetic surgery as well as modifications of existing microorganisms to produce beneficial results.

The Human Genome Project has been able to pinpoint the location and sequence of the approximately 100,000 human genes.[\[11\]](#) Further advances in biotechnology will allow

scientists to repair these defective sequences and eventually remove these genetic diseases from our population.

Genetic disease is not part of God's plan for the world. It is the result of the Fall (Gen. 3). Christians can apply technology to fight these evils without being accused of fighting against God's will.[\[12\]](#) Genetic engineering can and should be used to treat and cure genetic diseases.

A second type of research is the creation of new forms of life. While minor modifications of existing organisms may be permissible, Christians should be concerned about the large-scale production of novel life forms. That potential impact on the environment and on mankind could be considerable. Science is replete with examples of what can happen when an existing organism is introduced into a new environment (e.g., the rabbit into Australia, the rat to Hawaii, or the gypsy moth in the United States). One can only imagine the potential devastation that could occur when a newly created organism is introduced into a new environment.

God created plants and animals as "kinds" (Gen. 1:24). While there is minor variability within these created kinds, there are built-in barriers between these created kinds. Redesigning creatures of any kind cannot be predicted the same way new elements on the periodic chart can be predicted for properties even before they are discovered. Recombinant DNA technology offers great promise in treating genetic disease, but Christians should also be vigilant. While this technology should be used to repair genetic defects, it should not be used to confer the role of creator on scientists.

A related issue in the field of biotechnology is human cloning. It appears that the cloning of a human being will no doubt take place some time in the future since many other mammals have been cloned. Proponents of human cloning argue that it would be a worthwhile scientific endeavor for at least three reasons. First, cloning could be used to produce spare

parts. The clone would be genetically identical to the original person, so that a donated organ would not be rejected by the immune system. Second, they argue that cloning might be a way to replace a lost child. A dying infant or child could be cloned so that a couple would replace the child with a genetically identical child. Third, cloning could produce biological immortality. One woman approached scientists in order to clone her deceased father and offered to carry the cloned baby to term herself.[\[13\]](#)

While cloning of various organisms may be permissible, cloning a human being raises significant questions beginning with the issue of the sanctity of life. Human beings are created in the image of God (Gen. 1:27-28) and therefore differ from animals. Human cloning would certainly threaten the sanctity of human life at a number of levels. First, cloning is an inefficient process of procreation as shown in cloning of a sheep. Second, cloning would no doubt produce genetic accidents. Previous experiments with frogs produced numerous embryos that did not survive, and many of those that did survive developed into grotesque monsters. Third, researchers often clone human embryos for various experiments. Although the National Bioethics Advisory Commission did ban cloning of human beings, it permitted the cloning of human embryos for research. Since these embryos are ultimately destroyed, this research raises the same pro-life concerns discussed in the chapter on abortion.

Cloning represents a tampering with the reproductive process at the most basic level. Cloning a human being certainly strays substantially from God's intended procedure of a man and woman producing children within the bounds of matrimony (Gen. 2:24). All sorts of bizarre scenarios can be envisioned. Some homosexual advocates argue that cloning would be an ideal way for homosexual men to reproduce themselves.

Although this would be an alternative form of reproduction, it is reasonable to believe that human clones would still be

fully human. For example, some people wonder if a clone would have a soul since this would be such a diversion from God's intended process of procreation. A traducian view of the origin of the soul, where a person receives both body and soul from his parents rather than an act of special creation by God, would imply that a cloned human being would have a soul. In a sense a clone would be no different from an identical twin.

Human cloning, like other forms of genetic engineering, could be used to usher in a "brave new world." James Bonner says "there is nothing to prevent us from taking a thousand [cells]. We could grow any desired number of genetically identical people from individuals who have desirable characteristics."[\[14\]](#) Such a vision conjures up images of Alphas, Betas, Gammas, and Deltas from Aldous Huxley's book *Brave New World* and provides a dismal contrast to God's creation of each individual as unique.

Each person contributes to both the unity and diversity of humanity. This is perhaps best expressed by the Jewish Midrash: "For a man stamps many coins in one mold and they are all alike; but the King who is king over all kings, the Holy One blessed be he, stamped every man in the mold of the first man, yet not one of them resembles his fellow."[\[15\]](#) Christians should reject future research plans to clone a human being and should reject using cloning as an alternative means of reproduction.

The Challenge of Information Technology

The information revolution is the latest technological advance Christians must consider. The shift to computers and an information-based society has been swift as well as spectacular. The first electronic digital computer, ENIAC, weighed thirty tons, had 18,000 vacuum tubes, and occupied a space as large as a boxcar.[\[16\]](#) Less than forty years later, many hand-held calculators had comparable computing power for

a few dollars. Today most people have a computer on their desk with more computing power than engineers could imagine just a few years ago.

The impact of computers on our society was probably best seen when in 1982 *Time* magazine picked the computer as its “Man of the Year”—actually listing it as “Machine of the Year.”[\[17\]](#) It is hard to imagine a picture of the Spirit of St. Louis or an Apollo lander on the magazine cover under a banner “Machine of the Year.” This perhaps shows how influential the computer has become in our society.

The computer has become helpful in managing knowledge at a time when the amount of information is expanding exponentially. The information stored in the world’s libraries and computers doubles every eight years.[\[18\]](#) In a sense the computer age and the information age seem to go hand in hand.

The rapid development and deployment of computing power however has also raised some significant social and moral questions. People in this society need to think clearly about these issues, but often ignore them or become confused.

One key issue is computer crime. In a sense computer fraud is merely a new field with old problems. Computer crimes are often nothing more than fraud, larceny, and embezzlement carried out by more sophisticated means. The crimes usually involve changing address, records, or files. In short, they are old-fashioned crimes using high technology.

Another concern arises from the centralization of information. Governmental agencies, banks, and businesses use computers to collect information on its citizens and customers. For example, it is estimated that the federal government has on average about fifteen files on each American.[\[19\]](#) Nothing is inherently wrong with collecting information if the information can be kept confidential and is not used for immoral actions. Unfortunately this is often difficult to

guarantee.

In an information-based society, the centralization of information can be as dangerous as the centralization of power. Given sinful man in a fallen world, we should be concerned about the collection and manipulation of vast amounts of personal information.

In the past, centralized information processing was used for persecution. When Adolf Hitler's Gestapo began rounding up millions of Jews, information about their religious affiliation was stored in shoe boxes. U.S. Census Bureau punch cards were used to round up Japanese Americans living on the West Coast at the beginning of World War II.[\[20\]](#) Modern technology makes this task much easier. Governmental agencies routinely collect information about citizens' ethnic origin, race, religion, gross income, and even political preference.

Moreover, the problem is not limited to governmental agencies. Many banking systems, for example, utilize electronic funds-transfer systems. Plans to link these systems together into a national system could also provide a means of tracking the actions of citizens. A centralized banking network could fulfill nearly every information need a malevolent dictator might have. This is not to say that such a thing will happen. It does mean, however, that societies that want to monitor their citizens will be able to do so more efficiently with computer technology.

A related problem arises from the confidentiality of computer records. Computer records can be abused like any other system. Reputations built up over a lifetime can be ruined by computer errors and often there is little recourse for the victim. Congress passed the 1974 Privacy Act which allows citizens to find out what records federal bureaucracies have on them and to correct any errors.[\[21\]](#) But more legislation is needed than this particular act.

The proliferation of computers has presented another set of social and moral concerns. In the recent past most of that information was centralized and required the expertise of the "high priests of FORTRAN" to utilize it. Now most people have access to information because of increasing numbers of personal computers and increased access to information through the Internet. This access to information will have many interesting sociological ramifications, and it is also creating a set of troubling ethical questions. The proliferation of computers that can tie into other computers provides more opportunities for computerized crime.

The news media frequently carry reports about computer "hackers" who have been able to gain access to confidential computer systems and obtain or interfere with the data banks. Although these were supposed to be secure systems, enterprising computer hackers broke in anyway. In many cases this merely involved curious teenagers. Nevertheless computer hacking has become a developing area of crime. Criminals might use computer access to forge documents, change records, and draft checks. They can even use computers for blackmail by holding files for ransom and threatening to destroy them if their demands are not met. Unless better methods of security are found, professional criminals will begin to crack computer security codes and gain quick access into sensitive files.

As with most technological breakthroughs, engineers have outrun lawmakers. Computer deployment has created a number of legal questions. First, there is the problem of establishing penalties of computer crime. Typically, intellectual property has a different status in our criminal justice system. Legal scholars should evaluate the notion that ideas and information need not be protected in the same way as property. Legislators need to enact computer information protection laws that will deter criminals, or even curious computer hackers, from breaking into confidential records.

A second legal problem arises from the question of

jurisdiction. Telecommunications allows information to be shared across state and even national borders. Few federal statutes govern this area and less than half the states have laws dealing with information abuse.

Enforcement will also be a problem for several reasons. One reason is the previously stated problem of jurisdiction. Another is that police departments rarely train their personnel in computer abuse and fraud. A third reason is lack of personnel. Computers are nearly as ubiquitous as telephones or photocopiers.

Computer fraud also raises questions about the role of insurance companies. How do companies insure an electronic asset? What value does computer information have? These questions also need to be addressed in the future.

Technology and Human Nature

These new technologies will also challenge our views of human nature. Already medical technology is challenging our views of what it means to be human. A key question in the abortion debate is, When does human life begin? Is an embryo human? What about a developing fetus? Although the Bible provides answers to these questions, society often takes its cue from pronouncements that do not square with biblical truth.

Biotechnology raises yet another set of questions. Is a frozen embryo human and deserving of a right to life? Is a clone human? Would a clone have a soul? These and many more questions will have to be answered. Although the Bible doesn't directly address such issues as genetically engineered humans or clones, key biblical passages (Ps. 139, Ps. 51:5) certainly seem to teach that an embryo is a human created in the image of God.

Information technology also raises questions about human nature in an unexpected way. Researchers believe that as

computer technology advances, we will begin to analyze the human mind in physical terms. In *The Society of Mind*, Marvin Minsky, professor at the Massachusetts Institute of Technology, says that “the mind, the soul, the self, are not a singly ghostly entity but a society of agents, deeply integrated, yet each one rather mindless on its own.”[\[22\]](#) He dreams of being able ultimately to reduce mind (and therefore human nature) to natural mechanism. Obviously this is not an empirical statement, but a metaphysical one that attempts to reduce everything (including mind) to matter.

Will we some day elevate computers to the level of humanity? One article asked the question, Would an Intelligent Computer Have a “Right to Life?”[\[23\]](#) Granting computer rights might be something society might consider since many are already willing to grant certain rights to animals.

In a sense the question is whether an intelligent computer would have a soul and therefore access to fundamental human rights. As bizarre as the question may sound, it was no doubt inevitable. When 17th century philosopher Gottfried Wilhelm von Leibniz first described a thinking machine, he was careful to point out that this machine would not have a soul—fearful perhaps of reaction from the church. Already scientists predict that computer intelligence will create “an intelligence beyond man’s” and provide wonderful new capabilities.[\[25\]](#) One of the great challenges in the future will be how to manage new computing power that will outstrip human intelligence.

Once again this is a challenge for Christians in the 21 st century. Human beings are more than just proteins and nucleic acids. Human beings are more than bits and bytes. We are created in the image of God and therefore have a spiritual dimension. Perhaps this must be our central message to a world enamored with technology: human beings are created in the image of God and must be treated with dignity and respect.

Notes

1. Memo from Charles H. Duell, Director of the U.S. Patent Office, 1899.
2. Jacques Ellul, *The Technological Society* (New York: Vintage, 1964).
3. C. S. Lewis, *The Abolition of Man* (New York: Macmillan, 1947), 6869, 71 (*italics his*).
4. Ethan Singer, cited in Nicholas Wade, "Gene Splicing: Congress Starts Framing Law for Research," *Science*, 1 April 1977, 39.
5. Michael Crichton, *The Andromeda Strain* (New York: Dell, 1969).
6. Kenneth Woodward, "Thou Shalt Not Patent!" *Newsweek*, 29 May 1995, 68.
7. Testimony by Ethan Singer before the Subcommittee on Health and the Environment, House Committee on Interstate and Foreign Commerce, *Hearings*, 15 March 1977, 79.
8. Julian Huxley, cited in Joseph Fletcher, *The Ethics of Genetic Control* (Garden City, NY: Anchor, 1974), 8.
9. Erwin Chargaff, cited in George Wald, "The Case against Genetic Engineering," *The Sciences*, May 1976, 10.
10. Nancy McCann, "The DNA Maelstrom: Science and Industry Rewrite the Fifth Day of Creation," *Sojourners*, May 1977, 2326.
11. Philip Elmer-Dewitt, "The Genetic Revolution," *Time*, 17 January 1994, 49.
12. Skeptics sometimes argue that fighting disease is the same as fighting against God's will. Albert Camus poses this

dilemma for Dr. Reux in *The Plague*. Christians should follow the cultural mandate (Gen. 1:28) and use genetic technology to treat and cure genetic disease.

13. Sharon Begley, "Little Lamb, Who Made Thee?" *Newsweek*, 10 March 1997, 55.

14. James Bonner, quoted in *Los Angeles Times*, 17 May 1971, 1.

15. N. N. Glazer, *Hammer on the Rock: A Short Midrash Reader* (New York: Schocken, 1962), 15.

16. Philip Elmer-De-Witt, "A Birthday Party for ENIAC," *Time*, 24 February 1986, 63.

17. "Machine of the Year," *Time*, 3 January 1983, 1324.

18. "Harper's Index," *Harper's*, October 1984, 9.

19. Ted Gest, "Who Is Watching You?" *U.S. News and World Report*, 12 July 1982, 35.

20. David Burnham, *The Rise of the Computer State* (New York: Random House, 1983).

21. Martha Farnsworth Riche, "The Rising Tide of Privacy Laws," *American Demographics*, March 1990, 24.

22. Richard Lipkin, "Making Machines in Mind's Image," *Insight*, 15 February 1988, 812.

23. Robert Mueller and Erik Mueller, "Would an Intelligent Computer Have a 'Right to Life?'" *Creative Computing*, August 1983, 14961.

24. Danny Hillis, "Can They Feel Your Pain?" *Newsweek*, 5 May 1997, 57.

25. Robert Jastrow, "Toward an Intelligence beyond Man's," *Time*, 20 February 1978, 59.

Computers and the Information Revolution

The Impact of the Information Revolution

What has been the impact of the information revolution, and how should Christians respond? Those are the questions we will consider in this essay. Let's begin by considering how fast our world shifted to a computer-based society. At the end of World War 2, the first electronic digital computer ENIAC weighed thirty tons, had 18,000 vacuum tubes, and occupied a space as large as a boxcar. Less than forty years later, many hand-held calculators had comparable computing power for a few dollars. Today most people have a computer on their desk with more computing power than engineers could imagine just a few years ago.

The impact of computers on our society was probably best seen when in 1982 *Time* magazine picked the computer as its "Man of the Year," actually listing it as "Machine of the Year." It is hard to imagine a picture of the Spirit of St. Louis or an Apollo lander on the magazine cover under a banner "Machine of the Year." This perhaps shows how influential the computer has become in our society.

The computer has become helpful in managing knowledge at a time when the amount of information is expanding exponentially. The information stored in the world's libraries and computers doubles every eight years. In a sense the computer age and the information age seem to go hand in hand.

The rapid development and deployment of computing power however has also raised some significant social and moral questions. People in this society need to think clearly about these issues, but often ignore them or become confused.

One key issue is computer crime. In a sense, computer fraud is merely a new field with old problems. Computer crimes are often nothing more than fraud, larceny, and embezzlement carried out by more sophisticated means. The crimes usually involve changing address, records, or files. In short, they are old-fashioned crimes using high technology.

Another concern arises from the centralization of information. Governmental agencies, banks, and businesses use computers to collect information on its citizens and customers. For example, it is estimated that the federal government has on average about fifteen files on each American. Nothing is inherently wrong with collecting information if the information can be kept confidential and is not used for immoral actions. Unfortunately this is often difficult to guarantee.

In an information-based society, the centralization of information can be as dangerous as the centralization of power. Given sinful man in a fallen world, we should be concerned about the collection and manipulation of vast amounts of personal information.

In the past, centralized information processing was used for persecution. When Adolf Hitler's Gestapo began rounding up millions of Jews, information about their religious affiliation was stored in shoe boxes. U.S. Census Bureau punch cards were used to round up Japanese Americans living on the West Coast at the beginning of World War II. Modern technology makes this task much easier.

Moreover, the problem is not limited to governmental agencies. Many banking systems, for example, utilize electronic funds-

transfer systems. Plans to link these systems together into a national system could also provide a means of tracking the actions of citizens. A centralized banking network could fulfill nearly every information need a malevolent dictator might have. This is not to say that such a thing will happen, but it shows the challenges facing each of us due to the information revolution.

The Social Challenges of Computers

One of the biggest challenges raised by the widespread use of computers is privacy and the confidentiality of computer records. Computer records can be abused like any other system. Reputations built up over a lifetime can be ruined by computer errors and often there is little recourse for the victim. Congress passed the 1974 Privacy Act which allows citizens to find out what records federal bureaucracies have on them and to correct any errors. But more legislation is needed than this particular act and Congress needs to consider legislation that applies to the information revolution.

The proliferation of computers has presented another set of social and moral concerns. In the recent past most of that information was centralized and required the expertise of the "high priests of FORTRAN" to utilize it. Now most people have access to information because of increasing numbers of personal computers and increased access to information through the Internet. This access to information will have many interesting sociological ramifications, and it is also creating a set of troubling ethical questions. The proliferation of computers that can tie into other computers provides more opportunities for computerized crime.

The news media frequently carry reports about computer "hackers" who have been able to gain access to confidential computer systems and obtain or interfere with the data banks. Although these were supposed to be secure systems, enterprising computer hackers broke in anyway. In many cases

this merely involved curious teenagers. Nevertheless, computer hacking has become a developing area of crime. Criminals might use computer access to forge documents, change records, and draft checks. They can even use computers for blackmail by holding files for ransom and threatening to destroy them if their demands are not met. Unless better methods of security are found, professional criminals will begin to crack computer security codes and gain quick access into sensitive files.

As with most technological breakthroughs, engineers have outrun lawmakers. Computer deployment has created a number of legal questions. First, there is the problem of establishing penalties of computer crime. Typically, intellectual property has a different status in our criminal justice system. Legal scholars should evaluate the notion that ideas and information need not be protected in the same way as property. Legislators need to enact computer information protection laws that will deter criminals, or even curious computer hackers, from breaking into confidential records.

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Computer fraud also raises questions about the role of insurance companies. How do companies insure an electronic asset? What value does computer information have? These questions also need to be addressed in the future.

Computers are a wonderful tool, but like any technology poses new challenges in the social and political arenas. I believe that Christians should be the forefront of these new technologies providing wise direction and moral guidelines. We need Christians in the fields of computer technology and electrical engineering who can wisely guide us into the 21st century.

Principles for Computer Ethics

I would like to propose some principles for computer ethics. The first principle is that **one should never do with computers what he or she would consider immoral without them**. An act does not gain morality because a computer has made it easier to achieve. If it is unethical for someone to rummage through your desk, then it is equally unethical for that person to search your computer files. If it is illegal to violate copyright law and photocopy a book, then it is equally wrong to copy a disk of computer software.

A second principle is to **treat information as something that has value**. People who use computers to obtain unauthorized information often do not realize they are doing something wrong. Since information is not a tangible object and can be shared, it does not seem to them like stealing since it does not deprive someone of something. Yet in an information-based society, information is a valuable asset. Stealing information should carry similar legal penalties as stealing tangible objects.

A third principle is to remember that **computers are merely tools to be used, not technology to be worshiped**. God's mandate is to use technology wisely within His creation. Many commentators express concern that within an information society, people may be tempted to replace ethics with statistics.

Massive banks of computer data already exert a powerful

influence on public policy. Christians must resist society's tendency to undermine the moral basis of right and wrong with facts and figures. Unfortunately, growing evidence indicates that the computer revolution has been a contributing factor in the change from a moral foundation to a statistical one. The adoption of consensus ethics ("51 percent make it right") and the overuse of cost-benefit analysis (a modernized form of utilitarianism) give evidence of this shift.

Fourth, **computers should not replace human intelligence.** In *The Society of Mind* Marvin Minsky, professor at the Massachusetts Institute of Technology, says that "the mind, the soul, the self, are not a singly ghostly entity but a society of agents, deeply integrated, yet each one rather mindless on its own." He dreams of being able ultimately to reduce mind (and therefore human nature) to natural mechanism. Obviously this is not an empirical statement, but a metaphysical one that attempts to reduce everything (including mind) to matter.

The implications, however, are profound. Besides lowering humans to the material process, it begins to elevate machines to the human level. One article asked the question, Would an Intelligent Computer Have a "Right to Life?" Granting computer rights might be something society might consider since many are already willing to grant certain rights to animals.

In a sense the question is whether an intelligent computer would have a soul and therefore access to fundamental human rights. As bizarre as the question may sound, it was no doubt inevitable. When seventeenth-century philosopher Gottfried Wilhelm von Leibniz first described a thinking machine, he was careful to point out that this machine would not have a soul, fearful perhaps of reaction from the church. But this will be our challenge in the future: how to manage new computing power that will most likely outstrip human intelligence.

The Bible teaches that humans are more than bits and bytes,

more than blood and bones. Created in the image of God, human beings have spiritual dimensions. They are more than complex computers. Computers should be used for what they do best: analyze discrete data with objective criteria. Computers are a wonderful tool, but they should not replace human intelligence and intuition.

Biblical Principles Concerning Technology

I would like to present a set of biblical principles concerning technology in general and computer technology in particular.

In essence, technology is the systematic modification of the environment for human ends. Often it is a process or activity that extends or enhances a human function. A microscope, for example, extends man's visual perception. A tractor extends one's physical ability. A computer extends a person's ability to calculate. Technology also includes devices that make physical processes more efficient. The many chemical processes we use to make products fit this description of technology.

The biblical mandate for developing and using technology is stated in Genesis 1:28. God gave mankind dominion over the land, and we are obliged to use and manage these resources wisely in serving the Lord. God's ideal was not to have a world composed exclusively of primitive areas. Before the Fall (Gen. 2:15) Adam was to cultivate and keep the Garden of Eden. After the Fall the same command pertains to the application of technology to this fallen world, a world that "groans" in travail (Rom. 8:22). Technology can benefit mankind in exercising proper dominion, and thus remove some of the effects of the Fall (such as curing disease, breeding livestock, or growing better crops).

Technology is neither good or evil. The worldview behind the particular technology determines its value. In the Old Testament, technology was used both for good (e.g., the

building of the ark, Gen. 6) and for evil (e.g., the building of the Tower of Babel, Gen. 11). Therefore the focus should not be so much on the technology itself as on the philosophical motivation behind its use. There are a number of important principles that should be considered.

First, **technology should be seen as a tool, not as an end in itself.** There is nothing sacred about technology. Unfortunately Western culture tends to rely on it more than is appropriate. If a computer, for example, proves a particular point, people have a greater tendency to believe it than if the answer was a well-reasoned conclusion given by a person. If a machine can do the job, employers are prone to mechanize, even if human labor does a better or more creative job. Often our society unconsciously places machines over man. Humans become servants to machines rather than the other way around.

There is a tendency to look to science and engineering to solve problems that really may be due to human sinfulness (wars, prejudice, greed), the fallenness of the world (death, disease), or God's curse on Adam (finite resources). In Western culture especially, we tend to believe that technology will save us from our problems and thus we use technology as a substitute for God. Christians must not fall into this trap, but instead must exhibit their ultimate dependence on God. Christians must also differentiate between problems that demand a technological solution and ones that can be remedied by a social or spiritual one.

As Christians we should see the value of technology but not be seduced into believing that more and better technology will solve social and moral problems. Computers and the Internet will tell us more about *how* people live, but they won't tell us *how to* live. Televisions, VCRs, and computers may enrich our lives, but they won't provide the direction we need in our lives. The answer is not more computers and more technology. The ultimate answer to our problems is a personal relationship with Jesus Christ.

A second principle is that **technology should be applied in different ways, according to specific instructions.** For example, there are distinctions between man and animal that, because we are created in God's image (Gen. 1:26-27), call for different applications of medical science. Using artificial insemination to improve the genetic fitness of livestock does not justify using it on human beings. Christians should resist the idea that just because we can do something we should do it. Technological ability does not grant moral permission.

Many commentators, most notably E. F. Schumacher, have focused on the notion of appropriate technology. In Third World countries, for example, sophisticated energy-intensive and capital-intensive forms of agriculture may be inappropriate for the culture as it presently exists. Industrial advance often brings social disruption and increasing havoc to a society. Developing countries must use caution in choosing the appropriate steps to industrialize, lest they be greatly harmed in the process.

I believe we should resist the temptation to solve every problem with computers. Our society today seems bent to putting computers in every classroom and in every place of work. As helpful as computers may be, I believe we need to question this seemingly mindless attempt to fill our world with computers. They are a wonderful tool, but that is all they are. We must be careful not to substitute computers for basics like phonics, mathematics, logic, and wise business practices.

Third, **ethics rather than technology must determine the direction of our society.** Jacques Ellul has expressed the concern that technology moves society instead of vice versa. Our society today seems all too motivated by a technological imperative in our culture. The technological ability to do something is not the same as a moral imperative to do it. Technology should not determine ethics.

Though scientists may possess the technological ability to be gods, they nevertheless lack the capacity to act like gods. Too often, man has tried to use technology to become God. He uses it to work out his own physical salvation, to enhance his own evolution, or even to attempt to create life. Christians who take seriously human fallenness will humbly admit that we often do not know enough about God's creation to use technology wisely. The reality of human sinfulness means that society should be careful to prevent the use of technology for greed and exploitation.

Technology's fruits can be both sweet and bitter. C.S. Lewis writes in *The Abolition of Man*, "From this point of view, what we call Man's power over Nature turns out to be power exercised by some men over men with Nature as its instrument. . . . There neither is nor can be any simple increase of power on Man's side. Each new power won by man is a power over man as well. Each advance leaves him weaker as well as stronger. In every victory, besides being the general who triumphs, he is also the prisoner who follows the triumphal car."

Christians must bring strong biblical critique to each technological advance and analyze its impact. Computers are a wonderful tool, but Christians should constantly evaluate their impact as we live through the information revolution.

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