Report of the Commission on Christian Action

Reformed Church in America

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The Commission on Christian Action met November 16-17, 2000, on the campuses of Hope College and Western Theological Seminary in Holland, Michigan; and February 9-10, 2001, at the Xavier Retreat and Conference Center in Convent Station, New Jersey.

GENETIC TESTING AND SCREENING

The Commission on Christian Action presented reports on genetic engineering to the General Synod in 1988 and in 1999. The 1999 General Synod voted to circulate the 1999 report, "Genetic Engineering: An Update" (*MGS 1999*, pp. 87-98) and directed the Office of Social Witness and the RCA Distribution Center to make study resources available to RCA members and congregations (*MGS 1999*, R-28, p. 98). In November 2000 the commission and the Office of Social Witness presented a forum, "New Genetics: Issues in Science, Faith, and Ethics," on the campuses of Hope College and Western Theological Seminary. The1999 General Synod also directed the Commission on Christian Action to follow the 1999 paper with an analysis of the moral and ethical questions that genetic engineering raises, for report to the General Synod 2001 (*MGS 1999*, R-22, p. 98).

The explosion of new genetic technologies, increasingly available for widespread medical and legal use, has brought with it new and difficult ethical questions. These new questions are difficult because the technologies are breaking new ethical ground. There are few standards by which to make an ethical evaluation of the new technologies. Yet many will be faced with these questions for themselves, for family members, or by people seeking pastoral advice. It is important for the church to be involved in the questions raised by genetic technologies not only to serve church members who are faced with the questions brought about by genetic technologies but also to be a part of a dialogue about the ethical issues. To be an effective partner in this dialogue the church must be informed by *both* science and faith.

Genetic technology is a broad term that includes genetically engineered food, animal and human cloning, use of stem cells, gene therapy, gene replacement, genetic enhancement, genetic testing, and genetic screening. This paper focuses on genetic testing and screening, two of the most commonly used genetic technologies. The commission hopes to address issues raised by some of the other areas of genetic technologies in future papers.

Genetic testing employs a wide variety of laboratory tests to determine the genetic status of *individuals* already suspected to be at high risk for a particular genetic condition based on family history or a positive screening test. Genetic screening is the testing of apparently healthy individuals in a *population* to identify those at increased risk of genetic disease themselves or whose children (including future children) may be at increased risk of disease.

Techniques used for genetic testing and screening

Both genetic testing and genetic screening use similar or identical techniques. The techniques seek to identify some DNA change or genetic variant known to be associated with a genetic disease or to match a sample of DNA to the individual from whom it came. A genetic variant known to be associated with a genetic disease can be called a mutation or a mutant gene. Mutations can be inherited or acquired spontaneously. The mutant gene contributes to the disease by failing to produce the protein product it should or by producing a protein product that fails to perform its proper function. Mutant genes associated with many genetic diseases have been discovered and more are likely to be found as the Human Genome Project has now been completed and its information becomes readily available for research use. The actual techniques used for genetic testing and screening vary. The results of genetic tests depend on reliable laboratory procedures and accurate interpretation of the test results. The tests vary in their sensitivity or their ability to detect mutant genes in all patients that have or will have the disease associated with that mutant gene. The tests can be performed on embryos, fetuses, children, or adults. The precise technique used depends on the amount of tissue available for testing and the type of mutation expected. Techniques that are commonly used for genetic testing and screening include:

1. Ultrasound or sonograms use high frequency sound waves to image a fetus. This is a genetic test/screen that can identify genetic disorders that are already present as an observable phenotype (trait). For example, achondroplasia (a form of dwarfism) can be detected by ultrasound.
2. Karyotypes are an examination of banding patterns, size and number of an individual's chromosomes. This technique can detect large changes in chromosome number or structure. Down's syndrome can be detected by a karyotype.
3. Polymerase chain reaction (PCR) is a technique that amplifies minute amounts of DNA for further analysis, provided some sequence information about the trait is known. PCR is important if the sample for testing is very small. PCR is used to identify specific sequence changes or changes in the number of a small repeating sequence of DNA. PCR is used in pre-implantation genetic testing.
4. Restriction fragment length polymorphism (RFLP) is a technique that takes advantage of the fact that some mutations change the size of some DNA fragments. RFLP analysis can be used to identify single changes or other small changes in DNA sequence.
5. Variable number of tandem repeats (VNTR) is a technique that takes advantage of natural variation found in individuals and is useful in matching a sample of DNA to the individual from whom it came.
6. Allele-specific oligonucleotide hybridization (ASO) is used to detect a common and very specific mutation, known to cause a disease phenotype. ASO can be used to detect a carrier of the gene for cystic fibrosis.
7. DNA sequencing is used to determine the exact sequences of bases (nucleotides, often represented by the letters C, A, T, and G) in the gene of the individual being tested. DNA sequencing is used to detect mutant forms of the breast cancer genes, BRCA1 and BRCA2.
8. Chemical/protein detection identifies abnormal or absent protein

products of mutant genes; or excessive or insufficient chemical levels associated with failure of a gene product to function properly. Testing for phenylketonuria (PKU) detects unmetabolized phenylalanine, a natural product that is not metabolized in PKU patients.

Types of genetic testing and screening

Genetic testing and screening can be grouped into three major categories or types according to the reason for testing, the type of DNA variant expected, and the age or stage of development of the individual. The first category is testing or screening for **identification**. Genetic testing or screening for the purpose of identification can be used at any age after birth and a variety of DNA tests can be used. Common uses of genetic testing or screening for identification include legal cases to determine paternity, forensics to eliminate or include suspects in criminal investigations, or to identify victims of crimes. Testing or screening for identification can also be used to identify victims of war, accidents, or large-scale disasters such as earthquakes.

Genetic testing and screening can also be performed on **offspring**. Offspring may be tested at various times during development. Newborn genetic tests are performed on infants within days of birth. The tests can detect specific genetic diseases by examining a DNA or a blood sample from the infant. Some newborn tests are routine. For example, infants born in all U.S. states are routinely tested for phenylketonuria (PKU) and congenital hypothyroidism. If there is a family history of a specific genetic disease, other tests may be performed. These tests are done for reasons that extend beyond reassurance. For certain genetic diseases, early intervention, such as dietary restrictions or hormone therapy, can reduce or prevent the devastating consequences of the genetic disorder. Children with some genetic disorders clearly benefit from an early genetic test. But, for which genetic disorders should newborn tests be performed and who should make that decision? Three groups, the American Society of Human Genetics, the American College of Medical Genetics, and the Task Force on Genetic Testing created by the National Institutes of Health, suggest that genetic testing of children is justified when there is direct medical benefit for the child, a benefit that would be lost by waiting until the child reaches the age at which the disease manifests itself.

Prenatal testing is performed during pregnancy at various times between implantation of an embryo and birth. There are many forms of prenatal testing that are commonly used. Elevated alpha-fetoprotein levels in the mother's blood may indicate fetal neural defects. Ultrasound can image the development of fetal organs and can detect genetic abnormalities that disrupt normal organ development. Chorionic villi sampling and amniocentesis are genetic tests in which a sample of fetal cells is examined by karyotype or another genetic test. Karyotype analysis of fetal cells can detect large changes in chromosome number or structure. Typically these tests are done for reassurance that all is well with the pregnancy. However the test results give probabilities, not complete assurance. Karyotype analysis may not reveal some genetic abnormalities and ultrasound exams reveal only genetic diseases that are manifested as a visible abnormality.

Doing a genetic test is never a neutral act. The new knowledge requires a response, in some cases that may mean facing a difficult decision. When people seek genetic testing they must be ready to face the new responsibilities and sometimes difficult decisions presented by the knowledge the test will provide. It is not clear that individuals undergoing some of these common tests, such as ultrasound, recognize

them as genetic tests or are ready for the situation they face if the test results are different than they hoped or expected.

Pre-implantation testing is the newest form of genetic testing of offspring. It is used in conjunction with in vitro fertilization technology when couples know that there is a high probability that their offspring will have a genetic disease. Eggs are harvested from the mother and fertilized in vitro using sperm from the father and techniques that are now quite standard. The fertilized egg begins to grow, divide, and then a few cells from the embryo are removed and tested for a specific mutant gene. Only the embryos that lack the mutant form of the gene are used for implantation. The motivation for use of pre-implantation genetic testing is to have healthy babies and to avoid the suffering that accompanies so many genetic diseases. Increasing the likelihood of a healthy child and avoidance of suffering seem like good reasons to pursue pre-implantation genetic testing. Ethical questions come in to play, however, when people decide which diseases are serious enough to avoid. Ethicists caution against viewing children as commodities and ask if healthy children are a right or a gift. They suggest that our society is moving from an attitude of accepting the children we are given as gifts, to deciding which children, which gifts, we will accept. Prenatal and pre-implantation genetic testing intensifies the abortion issue. The status of and what is to be done with embryos not used for implantation remains unclear and controversial. Parents who, through prenatal testing, learn that the child they are expecting will suffer from a terrible genetic disease are faced with enduring the pain and suffering of abortion or the pain and suffering their child will experience.

The final category of genetic testing and screening is adult genetic testing/screening. A variety of techniques are used for genetic testing and screening of adults, depending on the nature of the genetic mutation that is expected. The techniques used, though, all try to identify a particular genetic mutation that can cause genetic disease but has not yet exhibited any symptoms. Adult genetic testing and screening is also done for several different reasons.

Carrier testing identifies individuals who are carriers of recessive genetic disorders. The individuals being tested are unaffected but have a possibility of giving birth to an affected child. Carrier testing is usually performed when individuals have reason to suspect they carry a mutant gene based on family history. The most common reason individuals seek carrier testing is to make informed childbearing decisions.

Alternatively, adults may seek genetic testing to define their risks for dominant late-onset disorders-genetic diseases in which disease symptoms do not appear until adulthood. Genetic testing for dominant late-onset genetic diseases, presymptomatic genetic testing, can detect an individual who will definitely succumb to a genetic disease later in life. Huntington's chorea is an example of such a disease. All individuals with a mutant form of the Huntington's disease gene will get Huntington's disease. Information from these tests does not (yet) provide escape from the disease, only knowledge about whether the person tested will or will not get the disease in the future. Presymptomatic testing is indicated if an individual has reason to suspect they carry a dominant late-onset gene based on family history.

Predispositional genetic testing is used to determine the risk for late-onset genetic diseases that have less than 100 percent penetrance. Individuals who carry these mutant gene forms are at increased risk for some genetic diseases but getting the disease is not inevitable. Many of the genetics tests available currently for late-onset genetic diseases with partial penetrance detect genes for cancer, heart disease, or Alzheimer's disease. An example of one such test is a test for the genes that

predispose individuals to breast cancer. BRCA1 is one of these genes and a genetic test for the mutant form of this gene is now available. Women face an 11 percent risk of getting breast cancer by age seventy. If, however, they carry a mutant form of BRCA1 that risk increases to 50 percent by age forty-seven and 80 percent by age seventy. A positive predispositional genetic test does not mean that an individual will get the disease for which he or she was tested and a negative test does not eliminate risk for the disease. The test refines the risk, providing a more accurate picture of the risk faced by the individual that was tested.

Consequences of genetic testing and screening

Genetic testing and screening offers many attractive benefits to individuals and to society. Identification testing can exonerate someone who was unjustly convicted or accused of a crime; it can identify victims of crimes, accidents, war, or disasters, giving information that may provide comfort and closure to family members; and it can clarify paternity, which may be important for financial, medical, or other reasons. Offspring testing and screening may provide reassurance to prospective parents, but it really only provides information about probabilities, not assurances. It can prevent the devastating effects of some genetic diseases or define care and management options for other diseases. Offspring testing can lead to avoidance of the suffering that would be an inevitable part of the life of a child born with a genetic disease, or provide parents with the information necessary to make an informed choice. Pre-implantation testing can greatly increase the probability of having a healthy baby. Adult testing aids in making informed childbearing decisions. It also clarifies an individual's risk for a particular disease, determining whether that individual is at the same risk as the general population or at a higher risk level. Clarifying risk can help define care and management options, such as revealing whether or not a significant lifestyle change is required, if aggressive drug therapy is necessary, or even if a prophylactic mastectomy or oophorectomy is warranted. Finally, test results can provide psychological relief regardless of the outcome. Patients usually indicate that the knowledge provided by genetic testing brings a sense of power-at least the enemy has been identified and they know what they are combating.

The information received from genetic testing can also lead to potential problems. Genetic testing patients may blame family members for passing on a mutant gene. Others may experience survivor's guilt, along with questions as to why they were spared and others were not. Some parents or grandparents may feel guilty for passing a defective gene to affected children. Other patients may develop a fatalistic view of life, coming to believe that we are nothing more than the products of our genes and all has been decided in advance.

Of great concern to genetic testing patients is the potential misuse or misappropriation of test findings that may result in loss of insurance (life, health, or disability) or in the denial of benefit payments. Other patients may be subjected to discriminatory actions, including the potential loss of employment due to the revelation of genetic test findings. Finally, some patients may experience recrimination from a society that may disagree with a particular life decision made in light of test information. Such may be the case of a parent who chooses to give birth to a critically ill child, nearly certain to succumb to death in early life, whose brief survival results in great financial cost to the health care system.

Issues for public policy

Public policy must address issues of safety and accuracy of the tests and the laboratories in which they are performed. Tests must be reliable and safe.

Furthermore, tests must be interpreted accurately. A fully certified genetic counselor should be involved whenever possible to communicate the information accurately and to provide counseling support.

Issues of confidentiality should also be addressed and must clearly regulate who has access to the information from genetic testing. If insurance companies pay for the test they may want access to the test results. But it is not yet clear whether they should have access to that information or if it belongs solely to the patient.

The requirements of informed consent must also be clearly regulated. Genetic testing is not done in isolation. The results affect the genetic status of other family members, offspring, and future offspring. Identification of the patient is not easy. For example, in prenatal testing, are the patients the parents or is the patient the child? If a person tests positive for a mutant gene, does that person owe that information to other family members who now have an increased probability of also carrying the mutant gene? Individuals seeking genetic testing must understand beforehand that the information acquired from genetic testing is not information they receive in a vacuum. The information will likely affect a large number of other people and those who will be affected should be informed before the test is performed.

Finally, genetic testing can be very expensive and society must deal with the issue of extreme disparity of available health care. While our society is debating the merits of genetic testing for rare diseases, children worldwide are dying of simple problems such as hunger and diarrhea. Jesus teaches us in the parable of the sheep and the goats (Matt. 25) that we are to be a voice for those who have no voice. "Truly I tell you, just as you did it to one of the least of these who are members of my family, you did it to me" (Matt. 25:40) and alternatively, "Truly I tell you, just as you did not do it to one of the least of these, you did not do it to me" (Matt 25:45).

The current state of disparity in health care between the wealthy and the poor should not be tolerable to Christians. Increased technology has the potential for making the current disparity greater. Genetic testing and screening should be available to all whom it could benefit, regardless of their income level. To that end, public policy must assure that health care programs for the poor provide necessary funds to pay for equal access to genetic testing and its benefits.

The outlook for the benefits of genetic testing and screening is optimistic. Genetic testing and screening has an enormous potential to contribute in a positive way to human society and individual lives. It can lead to increased quantity and/or quality of life, has the potential to reduce health care costs, and it is the first step in gene therapy or gene replacement technology. Gene therapy/replacement contains additional ethical concerns and in that light genetic testing and screening may actually lead to pharmacogenetic treatments and decreased need for gene therapy. Pharmacogenetics is a new area of research that uses specific genetic information for a patient to design drugs that will act best for that particular individual with their unique genetic structure. Genetic testing is one of the first steps in pharmacogenetics.

The role of the church

The church must be solidly informed by both faith and science if it is to play a role in shaping the ethical context surrounding genetic testing and screening. The church needs to possess an accurate, complete, and sophisticated understanding of the scientific issues. The scientific community appears to be open to ethical input, as evidenced by the money set aside by the Human Genome Project for studying the ethical issues that it evokes.

Genetic testing and screening provide us with increased information. The writer of Ecclesiastes reminds us that "with much wisdom comes much sorrow; the more knowledge the more grief" (Eccles. 1:18, NIV). Increased knowledge inevitably brings increased moral responsibility. Genetic testing is never a neutral act. Once information from genetic testing is acquired, there is no avoiding some response. Inaction is no less a response than action. The church needs to stand with, support, and share the love of Christ with our brothers and sisters responding to information received from genetic testing.

The church has an important role to play in providing a biblical perspective on disease, suffering, and wholeness. A deeper, more holistic perspective will offer a word of caution to society, which seems so eager to seize on the hope of perfection through technology. We must remind our fellow humanity that technological advances, no matter how marvelous, will not save us. Salvation and wholeness finally come only through Jesus Christ.

The church is always predisposed toward efforts both to alleviate suffering and value life, although neither is finally our ultimate loyalty. As we encounter issues surrounding genetic testing and screening, we proceed with caution, with accurate scientific information, and as prayerful, humble creatures.

Glossary

Alpha-fetoprotein (AFP) A protein normally synthesized by the liver, yolk sac, and GI tract of a human fetus, but which may be found elevated in the sera of adults having certain malignancies or carrying a fetus with neural defects.

Clone Organism, cells, or molecules that are descended from a single progenitor.

Congenital hypothyroidism Inherited condition in which the thyroid gland is overactive. The gland is usually enlarged, secreting greater than normal amounts of thyroid hormones, and the metabolic processes of the body are accelerated.

Deoxyribonucleic acid (DNA) A large nucleic acid molecule found primarily in the nuclei of cells where it functions as the carrier of genetic information.

Dominant late-onset disorders Disorders that are manifested when an individual carries only one copy of the mutant gene but the symptoms of the disease do not appear until after the age of reproduction.

Embryo The stage of human prenatal development between the time of implantation (about two weeks after conception) until the seventh or eighth week of development. The stage is characterized by rapid growth, differentiation of the major organ systems, and development of the main external features.

Fetus The stage of human prenatal development after the embryonic period, usually from the eighth week after conception to birth.

Gene replacement Form of gene therapy in which a normal or functional gene is introduced in such a way that it replaces the resident faulty gene, restoring normal function to the cell in which the replacement occurs.

Gene therapy The correction of a genetic deficiency in a cell by the addition of new DNA and its random insertion into the genome.

Genetic enhancement A form of gene therapy in which the resultant change does not correct a clear genetic deficiency, but rather improves or augments a normal function already present in the cell or organism.

Genetic screening The testing of apparently healthy individuals in a population to identify those at increased risk of genetic disease themselves or whose children (including future children) may be at increased risk of disease.

Genetic testing Tests that determine the genetic status of individuals already suspected to be at high risk for a particular genetic condition based on family history or a positive screening test.
Huntington's chorea A lethal human disease of nerve degeneration with late-age onset. It is inherited as an autosomal dominant phenotype.
In vitro fertilization Fusion of sperm and ovum (egg) outside of the female reproductive tract.
Karyotype The entire chromosome compliment of an individual or cell, as seen during mitotic metaphase.
Mastectomy The surgical removal of one or both breasts.
Mutant gene A gene carrying a mutation.
Mutation The process that produces a gene or chromosome set that differs from wild-type (normal/typical) or the gene or chromosome set that results from such a process.
Oophorectomy The surgical removal of one or both ovaries.
Pharmacogenetics New form of drug therapy that uses specific genetic information for a patient to design drugs that will act best for that particular individual with his or her unique genetic structure.
Phenotype The detectable outward manifestation of a specific gene or set of genes carried by an organism.
Phenylketonuria A human metabolic disease caused by a mutation in a gene encoding a phenylalanine-processing enzyme, which leads to mental retardation if not treated; inherited as an autosomal recessive phenotype.
Recessive genetic disorders Genetic disorder that is only expressed as a phenotype in individuals homozygous for the recessive gene; the individual must possess two copies of the mutant gene to express the phenotype.
Stem cells Cells that divide, generally asymmetrically, to give rise to two different progeny cells. One is a stem cell like the parental cell and the other is a cell that enters a differentiation or specialization pathway.

Resources

Willer, R.A., Editor, *Genetic Testing and Screening: Critical Engagement at the Intersection of Faith and Science*, Kirk House Publishers, 1998, ISBN 1886513112

Alliance of Genetic Support Groups, http://medhlp.netusa.net/222/agsg.html

Human Inheritable Genetic Modifications: Assessing Scientific, Ethical, Religious and Policy Issues, http://www.aaas.org/spp/dspp/sfrl/germline/main.htm

March of Dimes Birth Defects Foundation, http://www.noah.cuny.edu/providers/mod.html

National Reference Center for Bioethics Literature, http://www.georgetown.edu/ research/nrcbl/scopenotes/sn22.htm

National Society of Genetic Counselors, http://members.aol.com/nsgcweb/nsgchome.htm

The Council of Regional Networks, http://www.cc.emory.edu/pediatrics/corn/member/ coorlist.htm

The National Human Genome Research Institute, http://www4.od.nih.gov/oba/sacgt.htm

Understanding Genetic Testing, http://www.gene.com/ae/ae/aepc/nih/index.html

What is Genetic Testing? http://www.lbl.gov/education/elsi/frames/genetic-testing-f.html

R-105
To direct the RCA Distribution Center to make the paper, "Genetic Testing and Screening," and the 1999 paper, "Genetic Engineering: An Update," available to congregations for study and discussion. (ADOPTED)

R-106
To encourage RCA congregations to identify genetic counselors and other resource people in their communities who can help church members with education, guidance, and support concerning the issues of genetic testing and screening. (ADOPTED)
R-107
To encourage RCA seminaries to include in their curricula opportunities for study and discussion of the ethical issues raised by new genetic technologies. (ADOPTED)
R-108
To request that congregations send to the Office of Social Witness the names of genetic counselors, scientists, health professionals, and others who could serve as resource people and/or represent the denomination in ecumenical forums and dialogues concerning the issues raised by new genetic technologies.

- The advisory committee recommended:

R-108 (amendment)
To request that congregations send to the Office of Social Witness the names of genetic counselors, scientists, health professionals, <u>Christian ethicists,</u> and others who could serve as resource people and/or represent the denomination in ecumenical forums and dialogues concerning the issues raised by new genetic technologies. (ADOPTED AS AMENDED)

Reason: To ensure that Christian ethical perspectives are represented in the dialogues.

- The advisory committee presented a new recommendation:

R-109
To direct the Commission on Theology to produce a position paper on the ethical and theological implications of the paper,

"Genetic Testing and Screening," for report to General Synod 2003. (NOT ADOPTED)

Reason: To provide guidance and assistance to members of the RCA in dealing with these ethical issues.

- The advisory committee presented a new recommendation:

  R-110
  To request that the Office of Social Witness compile a summary of previous General Synod statements on genetics and related issues and make this available to the church. (ADOPTED)

Reason: To provide guidance and assistance to members of the RCA in dealing with these ethical issues.

- The advisory committee presented a new recommendation:

  R-111
  To direct the Office of Social Witness to explore with the larger Christian community the ethical and theological issues raised by new genetic technologies. (ADOPTED)

Reason: To cooperate with other Christian communities in offering ethical counsel to the wider society.