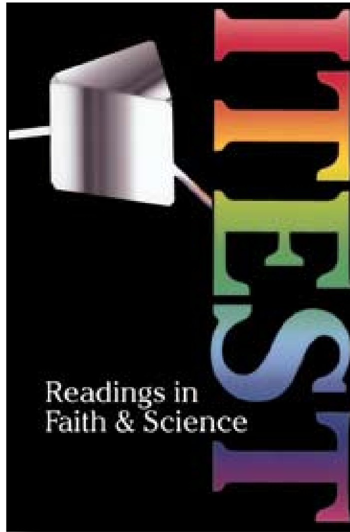

Readings II in Faith & Science

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Reproductive Biology

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Reproductive Biology

I have just finished my first year of medical school, an exercise in mass memorization. I have the summer off to rest my brain and to think about and understand some of the things I have learned. A first year medical student learns mostly about normal anatomy and physiology; how a healthy body and its parts work. It is an exciting year, one in which I really began to appreciate the incredible intricacy of human life.

My genetics class allowed me to see the human body in its most basic constituents; cells and the molecules responsible for the genetic code, DNA. DNA serves as the instruction manual from which we develop into human beings. Sitting back and reviewing the complicated chain of biochemical events, it amazes me that all these factors come together to work properly. However, sometimes the process doesn't fit together so precisely. Most of us do not realize it, but we each possess at least a few errors in our genetic code, creating malfunctioning genes. Fortunately human beings carry two copies of each gene; the correct gene usually compensates for a malfunctioning one. Not everyone is so lucky, though. Some traits require both members of a gene pair to function correctly.

In addition, two people, each of which possess a mutation on one particular gene, could have children who received the malfunctioning gene from both parents, instead of one malfunctional and one functional gene which could compensate for the defect. In these cases there is an abnormality in the child's physiology which causes disease or developmental abnormalities. A major focus of genetics and biochemistry research is finding ways to permanently cure many of these diseases.

While this goal has not been reached, the progress made has provided many of the treatments of genetic disease used in medicine today. Research into human genetics and genetic diseases is rapidly expanding. The Human Genome Project, a research project promoted and funded by the federal government, hopes to have mapped the entire human genome by the early part of the next century. This means they hope to know the chromosomal location and DNA composition of every gene humans possess. I worry, however, that new discoveries made in this field are proceeding faster than the development of philosophical and ethical rules that tend to regulate scientific and medical research.

Currently, information about the physiological and metabolic problems underlying genetic diseases allows us to treat, though not cure, many of them. Common methods include dietary restrictions or supplementation, drug therapy and others. In addition, the transplantation of normal cells to provide a function that an individual's own cells cannot, is currently being investigated to treat some diseases. This concept is similar to the idea behind organ transplantation. For example, normal insulin producing cells are being transplanted into the pancreas of patients with insulin-dependent diabetes whose own cells do not function. The hope for gene transfer therapy is to be able to correct mutant genotypes in the patients own cells by transferring copies of a functional gene into the malfunctional genome.

These procedures are currently being done in animals and the first trials are underway in humans. A complication of the gene transfer procedures currently performed is that many tissue types, particularly nervous tissues, are comprised of cells which divide very little. This makes it very difficult to get enough of the good, functional DNA into the body tissue to compensate for the problems caused by the patients own erroneous DNA. A possible remedy to this is to detect and cure the genetic defects while the individuals are still fetuses, when cells are still rapidly dividing, and a correct, functional DNA sequence may be inserted, and then copied to the dividing cells.

The idea of altering a person's genome, understandably, makes people nervous. Currently gene therapy in humans is restricted to somatic cell lines, i.e. cells that are neither sperm nor egg cells, so that an individual's own DNA may be altered in certain tissues (pancreas, for example), but the genetic change is not inherited by any of his or her descendants. Gene therapy in human germ (egg or sperm) cells is very controversial due to the fact that people can't agree on the morality of changing the genetic makeup of future generations. Most people, however,

would probably welcome a therapy capable of removing a serious genetic defect from their genetic line forever. It seems that the benefits presented by the eradication of deleterious mutations that cause serious diseases such as Tay Sachs, where the infant is born with severe mental and physical deficiency and dies by the age of two or three, outweigh the risks involved with tampering with the genetic code. Although few might argue that diseases such as Tay Sachs would not merit gene therapy, other disease such as Downs Syndrome, deafness or dwarfism are more difficult to agree on. Should germ line gene therapy be considered only for diseases that meet certain standards? What should these criteria be? Who should set these standards? Should we use gene therapy to enhance genetic lines; to make people smarter, taller, stronger or more attractive? The big problem is that we probably could not all agree on what would be an improvement. In addition if we limit access to gene therapy to people with financial resources to pay for it, could that create a permanent underclass of people not only economically but mentally or physically disadvantaged too? Until we can answer such questions, a moratorium on the use of human germ line cells in experimentation and therapy exists.

Biochemical genetics is currently used extensively in prenatal diagnosis, particularly in older mothers and in cases where family history of a genetic disease is present. However, medicine is unable to cure or even treat most genetic diseases. Prenatal diagnosis alerts parents that they are at high risk of having a child with a genetic abnormality. These parents have the option, within the legal time limit, to abort it. However, diagnostic results are not 100% reliable and for many genetic abnormalities it is impossible to determine the extent to which it will be expressed, indeed if it will be expressed at all. An example of an abnormality with variable expressivity is Downs Syndrome. Children with Downs Syndrome vary from so mildly retarded that it is hardly detectable to severely retarded.

As a doctor I face a difficult dilemma. The medical profession considers it very important for a doctor to ignore his own personal opinions when treating his patients. However, since I consider a fetus a human life, and no less my patient than the mother, I feel morally obligated to try to dissuade parents from choosing abortion as an option. Although prenatal testing can sometimes be helpful in providing better care to the baby or mother before or after the birth, generally at this point its primary use is to detect fetuses with genetic defects. This area opens up some problems for me. I have grown up believing that having children is a gamble. If you have children you hope for the best, but you accept them and love them even if they have webbed feet, seven toes, mental retardation or worse.

Babies are born with no faces or brains; many of them die almost immediately, others are so mentally deficient that they will never walk or talk. Is it within my rights to expect people to bear burdens that I have never had to experience? Is there something about these children that perhaps can enhance these people's lives? It seems that the Christian tradition perhaps recognizes that, though suffering is not necessarily a good thing, good can be gleaned out of it. Is there some type of sanctity in suffering? Where does my responsibility as my patients' doctor end and my responsibility as a Christian who believes in the rights of the unborn begin? The U.S. courts have ruled that it is negligent not to offer prenatal genetic testing to parents. On the other hand, am I morally remiss if I offer alternatives to my patients that I believe to be wrong? If I do not offer prenatal testing unless absolutely forced to, am I manipulating people into behaving according to my own beliefs? Since I might be saving a life, does the end justify the means? These are questions to which, unfortunately, I do not have all the answers.

Artificial insemination is another technique of modern medicine which enables women whose spouses' sperm cannot fertilize their egg, due to low sperm count or motility or a variety of other problems, to get pregnant and have children. It is possible to collect and concentrate sperm, then artificially inject it into the prospective mother at her time of optimum fertility. If it is necessary, an ovum can be removed and fertilized in vitro (in a test tube environment) and then implanted back into the uterus. These procedures are becoming more prevalent and have enabled many couples to become biological parents. In cases where a husband's sperm is unable to fertilize the ova or if a woman does not have a partner, semen may be obtained from a sperm bank. If a woman has a defect in her own ova, viable ova may be obtained from an egg bank.

Moral and legal questions surround the practice of gamete donation. Let me explain some of my personal dilemmas about it. In my college newspaper the classified section advertises ways to make money. Invariably there are two big boxes advertising "fast" cash. One is asking for plasma donors and the other is looking for sperm donors. I know several people who donated semen all the way through college as supplemental income because, once you get cleared to do it, it is easier than donating plasma. Yet, I can't help feeling that allowing gametes to be bought and sold establishes them as a sort of commodity that they are not. Allowing people to sell their gametes for extra money in the same way that they sell their plasma ignores the genetic bond that exists between a "donor" and his or her progeny. Donated plasma mixes with the recipients own and becomes indistinguishable from it. The donated plasma is eventually broken down by the body's natural, cellular clean-up crews.

A child who develops from a donated gamete, however, will always bear traits specifically attributable to the `donor' -- certain eye color, a big nose, a predisposition to high cholesterol, depression or other things. In addition to this genetic bond, do people have any type of moral responsibility to defend or nurture their progeny? A couple of years ago on the news, I saw the court battle between prospective parents and the surrogate mother they had hired to carry a child for them. The surrogate mother decided that she did not want to give up the child that she had carried and nourished for nine months, as she had agreed in her contract. To whom does a child belong -- the people from whom a child received its genetic code or the person in whose body a child develops? Take this one step farther. Who really are the legal parents of a child -- the genetic parents or the people who raise the child? Lately, starting with the Baby Jessica case in Michigan and Iowa, this has become big news in the United States. [Although it is "news" any more] these questions of parental responsibility and rights are still not resolved and continue to cause problems for potential adoptive parents, gamete recipients, and couples requesting the services of a surrogate mother.

One of the ironies of reproductive genetics is that the technology that is now used primarily to screen fetuses for genetic defects also represents our greatest hope for the future treatment and cures of many genetic diseases. I cannot help wondering if any of the scientists who mapped genetic defects while looking for their cures, wish now that they had not. Would we be better off if these discoveries had never been made? The parents of children with such genetic diseases would probably say no, because these discoveries bring us closer to finding cures. Most discoveries can be used for harm as well as good.

A simple analogy might be the discovery of the process for making steel whereby carbon and iron are heated together to make an exceptionally strong metal. Steel, since its introduction, has been used in the manufacture of swords and spears but also in the manufacture of plowshares and other agricultural implements. Despite its destructive power, few doubt steel has benefitted civilization immensely. A quote by Herman Feifel says, "Science equips man but it does not guide him." So it is with research in genetics and the conscience. One should guide the other.

As a student, I have always preferred science and math to science and philosophy, because I can arrive at a correct answer which no one can refute or debate. The more I learn about science and medicine, however, the more I learn that there are no such things as "pure science" or strictly "clinical medicine." Scientific results are used by people; medicine is used on people. These people all have their own philosophies which affect the way they use and react to science and medicine.

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Questions

We often hear the statement: “The end does not justify the means.” If the end does not justify the means, what does? Can we say, however, that any end will justify any means? Is there need here for a more careful and accurate statement? How would you formulate that statement? The statement “`Science equips man but it does not guide him.’ One should guide the other.” is strongly reminiscent of one of the statements of Pope John Paul II: “Science can purify religion from error and superstition; religion can purify science from idolatry and false absolutes. Each can draw the other into a wider world, a world in which both can flourish.” What in science represents `idolatry and false absolutes’ ? What in Christianity can be classified as `error and superstition’ ? In other words, how, practically, can science be of service to Christianity and how can Christianity be of service to science? Any examples? People are involved in both science and religion. People are not governed by mathematics. How does this reflect back into both science and religion? Does science set its own agenda or does public pressure play a great role in directing it? Is the same true of religion?

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