treat these problems before birth.

There is a genetic disease known as Hurler's syndrome which results from a deficient production of an enzyme to break down complex carbohydrates which build up in the body's system and result in death before adulthood. There is now proposed a therapeutic technique which provides the fetus with cells from a fetal donor which will produce the required enzyme to break down the carbohydrates. However, there are present some ethical issues which need first to be resolved (A. S. Moraczewski, "The Unborn and Technology," Ethics & Medics (June 1991).

Genetic counselors cannot be held morally responsible for the moral judgments of those whom they counsel. However, it certainly would not violate the standards of their profession if they indicated to their counselees their convictions about the immorality of contraception and abortion. However, if they tried to interfere with the decision of those whom they were counseling they could well lose their license and could find themselves the object of a lawsuit.

The least problematical of gene manipulations are of course therapeutic interventions. In 1983 Pope John Paul II addressed the World Medical Association Convention and said that "strictly therapeutic intervention" can be "considered in principle as desirable" (Pope John Paul II, "The Ethics of Genetic Manipulation," Origins, Nov. 17, 1983, p. 388). Accepted professional and moral norms would have to be applied in such situations: the informed consent of the patient or his proxy if he were incompetent, the maintaining of confidentiality, a weighing of the proportion of risk to benefit for the patient, the avoidance of any procedure which would do direct harm to the patient without carrying any therapeutic benefit. That last consideration must be mentioned since there are actually those who advocate the direct killing of those suffering from a genetic disorder for the victim's "benefit!"

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### Genetics and Dominion over Nature

Mention the Ebola virus at a dinner party and you are sure of getting some attention. Books like The Hot Zone by Richard Preston or a film such as "Outbreak" with Dustin Hoffman have left a sense of uneasiness among the general public. The lead article in the May 22, 1995 issue of Newsweek focused attention of the reader by its cover message: "Killer Virus: Beyond the Ebola Scare—What Else Is Out There?" Unknown powers, often considered malevolent, evoke fear in most people. In somewhat the same way, talk about genetic manipulation generates concern that a few human beings, closed in a laboratory somewhere, will create new life forms that will overwhelm us.

**Genetic Manipulation in Nature**

Yet as a matter of act, unknown to many, the "creation" of modified life forms is occurring right now. Nature, if you will, is the culprit: she is modifying bacteria—as she does with viruses—that have become resistant to most currently available antibiotics (see Marc Lipsitch, "Fears Growing over Bacteria Resistant to Antibiotics," The New York Times, September 12, 1995, pp. B5-B6). It is no wonder, then, that the public is growing wary that "mad" scientists, or sane and noble scientists unwittingly, will produce in their laboratories genetic monsters which could destroy our food supply or let loose a plague which none of our medications could neutralize.

While we cannot cavalierly dismiss these feared consequences as totally impossible, the likelihood of their being realized is very slim because of checks and balances which nature provides, and the societal forces which keep the actions of its members within certain limits. This is not to deny that something could go wrong, but fears of a "doom-bug" or "end-of-the-world machine" should not be the deciding factor in seeking to develop genetically modified organisms that would better human existence.

**Delegated Dominion from the Lord**

The Lord gave the human race a delegated dominion over the world and its non-human inhabitants:

Then God said: "Let us make man in our image, after our likeness. Let them have dominion over the fish of the sea, the birds of the air, and the cattle, and over all the wild animals and all the creatures that crawl on the ground." (Gen. 1:26)

And then a significant command is added, "God blessed them, saying; 'Be fertile and multiply; fill the earth and subdue it'" (Gen. 1:28a). The phrase, "Subdue the earth," should not be understood as over-coming, dominating and exploiting it as a triumphant army but rather in the sense of cultivating and developing it. That was the task given to Adam and Eve and their descendants: to expand the privileged conditions of the Garden of Eden to the wider and as yet unfinished world so that it would be a suitable habitat for the human race. But because of sin this mission of the human race was not to be realized smoothly, but with pain, sweat and tears. Yet the mission and the task

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remains to this day. Pope John Paul II has touched on the matter of genetic manipulation early in his pontificate. In addressing a group of scientists, he stated that:

There is no doubt that from many points of view technical progress born of scientific discoveries helps man to solve very serious problems, such as food, energy, and the struggle against certain diseases more than ever widespread in the third world countries. (L'Osservatore Romano, April 9, 1979, p.5)

**The Moral Dimension**

Later, in the same address, the Pope brings out the importance of the moral dimension and the moral responsibility of scientists:

It is incumbent on scientists of different disciplines...to use all your prestige in order that scientific implications abide by the moral norms in view of the protection and development of human life. (ibid.)

It is clear that the Church does not have any intrinsic opposition to scientific and technological advances in general or to genetic research in particular as such. But it does have great concern that the true good of human beings is being protected and promoted. Whatever technological advances are brought about should be directed to the authentic welfare of the human person. As examples of the proper application of genetic technology, one can suggest the use of genetically modified E. coli bacteria to produce human insulin (of which I am one of the beneficiaries), human growth hormone, and interferon (which can be used in the treatment of certain viral diseases). In each case, the human genes which, respectively, control the synthesis of insulin, growth hormone, and interferon had to be identified, isolated, and then introduced into the genome of the selected bacteria.

Other genetically modified plants and animals have been produced to meet some specific need: for example, specific plants have been genetically modified so that they can resist freezing or insect infestation more readily, or can produce more yield per pound of seed or acre of land; so too with cows that give more milk, or steers that produce a higher quality meat. Of course, improvement of the quality and quantity of food sources and their products can, and indeed is, being achieved by modifying the growing conditions of plants—common or rare—and by carefully planning breeding programs (see Tina Adler, "Black-Eyed Peas Go to Mars?" Science News, December 2, 1995). This latter process could be thought of as indirect genetic manipulation in as much as favorable genetic mutations, brought about by nature rather than human art, are selected and developed.

In another address, Pope John Paul II concludes by stating that:

Finally, I wish to recall, along with the few cases which I have cited that benefit from biological experimentation, the important advantages that come from the increase of food products and from the formation of new vegetal species for the benefit of all, especially people most in need. (Origins, Nov.4, 1982, p. 342)

True to his steadfast position, the Pope concludes his remarks with the insistence on the importance of the moral dimension in this sphere of human activity:

In terminating these reflections of mine, which show how much I approve and support your worthy researches, I reaffirm that they must all be subject to moral principles and values which respect and realize in its fullness the dignity of man. (ibid.)

While abuse is possible in this field, as in any human endeavor, a disproportionate fear should not lead to the stifling of genetic research with infra-human life. Ultimately such research and development are part of the process by which the human race exercises its God-given dominion over the earth. In turn, the delegated dominion is not merely to give humans a more comfortable life. It is to give glory to God by acknowledging his gifts that come to us through nature. In addition many genetic improvements permit the earth to carry a larger human population, fulfilling the command to “fill the earth.”

ASM