Making Sense of Bioethics
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Editing Our Own Genes?

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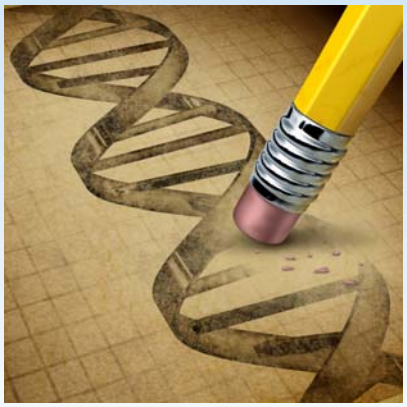

A number of serious diseases are known to occur because of defects or mutations in our DNA. Curing such diseases could in principle be carried out by rewriting the DNA to fix the mutated base pairs. Yet until recently scientists have remained largely stymied in their attempts to directly modify genes in a living animal.

Findings described in the March 30, 2014 issue of *Nature Biotechnology*, however, reveal that a remarkable gene-editing technique, known as CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats), can be used successfully in mice to reverse disease symptoms for a liver defect known as type I tyrosinemia. In humans, this potentially fatal ailment affects about one in 100,000 people. CRISPR, which enables researchers to snip out the mutated piece of DNA and replace it with the correct sequence, holds the potential for treating other genetic disorders as well. As the *MIT Technology Review* explains, the recently-developed CRISPR technique is proving to be remarkably versatile in the hands of biomedical researchers:

> "This technology could allow researchers to perform microsurgery on genes, precisely and easily changing a DNA sequence at exact locations on a chromosome.... CRISPR could make gene therapies more broadly applicable, providing remedies for simple genetic disorders like sickle-cell anemia and eventually even leading to cures for more complex diseases involving multiple genes. Most conventional gene therapies crudely place new genetic material at a random location in the cell and can only add a gene. In contrast, CRISPR and the other new tools also give scientists a precise way to delete and edit specific bits of DNA—even by changing a single base pair. This means they can rewrite the human genome at will."

Correcting mutations in the DNA to remedy a serious medical defect would certainly be desirable and permissible. In a 2008 document called *Dignitas Personae*, the Vatican's Congregation for the Doctrine of the Faith (CDF) agreed that trying to restore "the normal genetic configuration of the patient or to counter damage caused by genetic anomalies" would be morally acceptable as long as the person being treated

Editing Our Own Genes?

will not "be exposed to risks to his health or physical integrity which are excessive..."

Our ability to rewrite the human genome at will through precise DNA editing techniques, however, does raise substantial concerns about misusing the technology. In fact, researchers are already discussing the possibility of going beyond therapies and treatments, and instead, using CRISPR and other gene-alteration technologies to enhance human characteristics. For example, one possible direction would be to engineer changes in the genes of human muscles so that they could be worked harder and longer, thereby enhancing the performance of athletes and soldiers.

This kind of human re-engineering would cross an important line: instead of helping human beings who are struggling against serious diseases, scientists would now begin manipulating human beings for ulterior motives. As *Dignitas Personae* puts it, "such manipulation would promote a eugenic mentality and would lead to indirect social stigma with regard to people who lack certain qualities, while privileging [others]." The document also notes how attempting to create a new type of human being could unmask a dark and troubling ideology "in which man tries to take the place of his Creator," resulting in an "unjust domination of man over man."

Yet the line separating a therapy from an enhancement is not always an obvious one. Some researchers have claimed that the most common versions of genes that many people carry are not necessarily the ideal versions from the standpoint of health. Thus researchers might be able subtly to improve matters, for example, by rewriting normal genes so that people could better fight off infectious diseases. Would such a step be enhancement or therapy?

Even as scientists move forward with the project of rewriting our own genes to cure grave diseases, some will be tempted to go further and use techniques like CRISPR to engineer designer human embryos during *in vitro* fertilization; genetically modified monkeys have already been produced using this method in China. A prior CDF document called *Donum Vitae* unequivocally describes the grave problems with subjugating embryonic human beings for research purposes: "To use human embryos or fetuses as the object or instrument of experimentation constitutes a crime against their dignity as human beings having a right to the same respect that is due to the child already born and to every human person."

The remarkable tools becoming available not only for genetic therapies but also for human enhancement projects and embryonic manipulation raise daunting ethical concerns about the subjugation of man to his own technology, and call for thoughtful measures and vigilance to ensure the proper use of these techniques now and in the future.

Rev. Tadeusz Pacholczyk, Ph.D. earned his doctorate in neuroscience from Yale and did post-doctoral work at Harvard. He is a priest of the diocese of Fall River, MA, and serves as the Director of Education at The National Catholic Bioethics Center in Philadelphia. Father Tad writes a monthly column on timely life issues. From stem cell research to organ donation, abortion to euthanasia, he offers a clear and compelling analysis of modern bioethical questions, addressing issues we may confront at one time or another in our daily living. His column, entitled "Making Sense of Bioethics" is nationally syndicated in the U.S. to numerous diocesan newspapers, and has been reprinted by newspapers in England, Canada, Poland and Australia.