

## **ISSUES IN PERSPECTIVE**

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### ***Altering Human Heredity: Gene Editing and the Power of Genetic Technology***

On 1 December 2015, at the opening of a three-day meeting in Washington to discuss the ethics and use of gene editing, David Baltimore of the California Institute of Technology perceptively declared, “Over the years the unthinkable has become conceivable and today we are close to being able to alter human heredity.” This meeting, called the International Summit on Human Gene Editing, was convened by the national academies of three nations—the United States, Great Britain and China. The primary focus of this meeting was to discuss whether gene editing should be used to make heritable changes to the human gene line. The principal need for such a meeting is the development of the new, easy-to-use editing tool called CRISPR-Cas9. The Forum issued a non-enforceable recommendation that the world must move ahead with “extreme caution” in pursuing this new field of gene editing. What exactly is this new procedure and what are the ethical concerns it raises?

- First, it became a prominent issue when a group of scientists in China used a relatively new genetic technology called gene editing. Seeking to cure a disease called beta thalassemia, an inherited blood disease, they sought to abolish the broken gene that causes it. The technique seeks to modify genetically the stem cells that generate red blood corpuscles. But it is also theoretically possible to modify the broken gene in a fertilized egg (a zygote) and then allow the zygote to develop into a human being, thereby abolishing the disease not only in that new life but also in his or her “germ line,” that human’s line of descent. The result would be a genetically modified human being. This technique was utilized by Huang Jun-jiu and his colleagues at Sun Yat-sen University in Guangzhou, China. Gene editing uses a method called CRISPR-Cas9. CRISPR exploits a system a bacterium uses as a defense mechanism to protect itself from viruses. *The Economist* summarizes the technical dimension of this process: “In nature, it recognizes DNA sequences that are foreign to the bacterium, but the recognition mechanism can be modified to search for any given sequence and cut the DNA there. If this is done to a gene in an animal or plant cell, the cell will try to repair itself using the other copy present (for there is one for each parent) as a template. That process can be subverted by injecting an artificial template of the desired DNA sequence, which is then used as a model for repair.” The experiment in China involved 86 (unviable) zygotes, and, although the results were varied and complicated, in effect the experiment failed. But the failure provided significant lessons that might allow the approach to be modified in the future. There are at least four scientific groups working on gene editing in China today. It is also being used by a Cambridge, Massachusetts firm, Editas Medicine, which plans to use this technique in 2017 as a treatment for a rare genetic form of blindness

known as Leber congenital amaurosis. Great Britain recently announced using this technique in treating a one-year old leukemia patient.

- Second, many scientists are terrified about the future prospects of gene editing. Gina Kolata of the *New York Times* summarizes some of these fears: “[Scientists] fear the result will be the birth of babies whose every cell has been altered by scientists. . . This could happen well before researchers know enough about the consequences of editing genes, before they know how to edit safely and before society can debate if such procedures are even acceptable.” Edward Lanphier of Sangamo Biosciences in Richmond, California, argues that “genome editing in human embryos using current technology could have unpredictable effects on future generations. This makes it dangerous and ethically unacceptable.” For these reasons, a group of leading biologists has called for a worldwide moratorium on the use of genome-editing techniques that would alter human DNA in a way that babies could inherit. This decision is not legally enforceable, but it can influence decisions scientists make in their research and in the decisions of scientific journals to publish papers dealing with this kind of research. In addition to the dangers this kind of research can produce is the latent reality that gene editing could also empower scientists (and parents) to promote the kind of traits in their children that they desire. Because the technique holds the power to repair or enhance any human gene, the ugly term eugenics is the ethical elephant-in-the-room in this kind of research. George Q. Daley of Boston’s Children Hospital correctly observes that “It raises the most fundamental of issues about how we are going to view our humanity in the future and whether we are going to take the dramatic step of modifying our own germline and in a sense take control of our own genetic destiny, which raises enormous peril for humanity.” Antonio Regalado of *MIT Technology Review* writes that “If germline engineering becomes part of medical practice, it could lead to transformative changes in human well-being, with consequences to people’s life span, identity, and economic output. But it would create ethical dilemmas and social challenges. What if these improvements were available only to the richest societies, or the richest people?” Genetically-modified babies are no longer science fiction.
- Finally, what then should we do? Gene (genome) editing produces a legal, medical and ethical quagmire. Because of the crisis of moral authority in western civilization, there is no absolute ethical framework to help address these issues. There is a desperate need for some guidelines, rooted in God’s revelation. Therefore, what follows is a list of guiding principles to deal with reproductive and genetic technologies such as gene editing. Arguably not exhaustive, they offer some guidance, rooted in or inferred from God’s Word. These guiding principles do not provide definitive answers to all the legal and ethical challenges; rather, they offer a starting point for discerning Christians as they think through and then seek to make wise decisions.
  1. Human beings are created in God’s image—the fundamental basis for human value and worth. We can then stipulate that humans are always more valuable (intrinsically so) than all other created things. There is an essential, Creation-order

- distinction between humans and other created things (both living and non-living)—see Genesis 1 and 2. Hence, technology must always seek to preserve the worth, dignity and value of all human beings, regardless of age or stage of development.
2. Issues and practices associated with reproductive and genetic technologies fall under the stewardship responsibility of humanity to God. In Genesis 1:26ff, God created humans—male and female—in His image and then gave them the responsibility to “be fruitful and multiply, and fill the earth and subdue it; and rule over the fish of the sea and over the birds of the sky, and over every living thing that moves on the earth (1:28).” Verse 29 extends this dominion to plants, trees and seeds. God affirms this dominion status, although affected by human sin and rebellion, to Noah in Genesis 9:1-2. Because God is sovereign and humans have dominion status, human accountability is a necessary corollary. This matter of accountability has powerful implications when it comes to reproductive and genetic technologies. These technologies give humans power never realized before in history. But because of human depravity, it is difficult to be optimistic about the ultimate use of some of these technologies. In His common grace, God has permitted the human race to develop these technologies—but we must always remember that we are accountable to Him as to how we use them. With gene editing, we simply do not know the long term effects of its widespread use. The sobering fact of human depravity looms over its use.
  3. Human life itself is of higher value than the **quality** of human life. With the eternal perspective that Scripture gives, the quality of life ethic is faulty but seems to drive the current use of many of these technologies. Ethicist Michael Sandel writes that “In a world without givens, a world controlled by bioengineering, we would dictate our nature as well as our practices and norms. We would gain unprecedented power to redefine the good. . . The more successfully we engineered IQ and muscle-to-fat ratio, the more central these measures would become to our idea of perfection. . . But it w[ill] never be a perfect world.” [*The Case Against Perfection: Ethics in the Age of Genetic Engineering*, p. 5.] Because of sin, we live in an imperfect world, and, until the new heaven and new earth, our fallen world will be characterized by disease, tragedies, accidents and old age. The quality of life ethic, therefore, must never trump the infinite value of life ethic detailed in the Bible.
  4. From God’s perspective, concern for the improvement of the “inner man” is always more important than concern for improvement of the “outer man.” No procedure or practice will prevent the inevitability of death. Perhaps that is why the Scripture gives focus to such issues as the fruit of the Spirit (Galatians 5:22-23) and the eight quality traits called the Beatitudes (Matthew 5:1-16). From God’s perspective, these character traits are more paramount than using certain technologies to strive toward the goal of human perfectibility.

5. Carl Henry, years ago in his book, *Christian Personal Ethics (1957)*, provided an important guideline for wise decision-making when it comes to reproductive and genetic technologies: “Whatever tends to overcome what would be a deterioration in the created order and seeks to restore what God purposed in Creation is on far safer grounds than all kinds of novel and experimental enterprise.” In other words, he argued that there is clear biblical warrant for technologies that restore; there is no clear biblical warrant for manipulation toward perfection—an insightful guideline in approaching gene editing.
  
6. Finally, human civilization must critically examine the scientific (technological) imperative. Simply because society can pursue a particular medical, reproductive or genetic procedure does not mandate that it must! Especially in the area of genetics, “can” does not mandate “ought.” The potential for power and control and its obvious abuse mandates an examination of this imperative. Perhaps with some of these procedures, such as gene editing, it would be wise to not do them at all.

See Antonio Regalado, “Engineering the Perfect Baby,” *MIT Technology Review* (5 March 2015); Nicholas Wade in the *New York Times* (20 March 2015); Gina Kolata in the *New York Times* (24 April 2015); *The Economist* (5 December 2015), p. 79 and (2 May 2015), p. 71; and James P. Eckman, *Christian Ethics*, pp. 43-53.