

Preface: CRISPR Technology, Gene Editing

Around 2007, microbiologists in the food industry discovered how some bacteria, which are used in yogurt and cheese production, protect themselves against invading viruses. This discovery helped them explain why some yogurt cultures survived virus contamination while others did not. By 2013, scientists had not only unlocked the secret of the bacteria's adaptive immune system but also were able to apply that system to a wide range of uses that involve editing (deleting, repairing, or replacing genes) in the cells of any organism.

Although few people can remember the inscrutable name given to the gene editing system, namely "clustered, regularly interspaced, short palindromic repeats," its acronym CRISPR was about to become a scientific household name. Not since the introduction of recombinant DNA molecule technology in 1973 and to a lesser degree the invention of polymerase chain reaction in 1983 had a method of molecular genetics brought new excitement to the field of genetic engineering. It was acclaimed as simple, precise, inexpensive, and highly effective for modifying the DNA code in bacteria, plants, and animals.

"Gene editing" became the operative phrase to describe the technique, as DNA was considered analogous to computer code or the alphanumeric symbols on a page of print. But if it were that simple to make precise genetic changes in a cell's DNA, what about embryos? The news headlines began to capture the cultural angst about what science had uncovered. "The CRISPR craze"; "Embryo editing divides scientists"; "The path through the thicket"; "CRISPR democracy." "Scientists see way to rewrite code of life"; "Genetic 'typo' corrector."

Science magazine named CRISPR the breakthrough of the year. But revolutionary science often varies with its new ethical issues. Biologist J.B.S Haldane said in his 1928 Conway Memorial Lecture on science and ethics, "by complicating life, science creates new opportunities of wrongdoing; by altering our world view, it may lead us into one form or another of ethical nihilism; it can never do us harm by pointing out to us the consequences of our actions."¹

This special section presents six papers that address ethical issues of genetically altering the human germline. The subject has been a part of the national agenda since 1980, when President Jimmy Carter received a letter from three national religious leaders concerned about the possibilities that the new discoveries in molecular biology had for reactivating a eugenics program. This journal, which connects ethical issues in biology, engineering, and medicine, is an ideal venue to discuss CRISPR precisely because it cuts across the three disciplines.

The first paper, "Crossing the Germ-Line Barrier: The Three Genome Baby," provides a historical context for discussions about germline genetic engineering. It describes the shifting moral boundaries between somatic and germline genetic engineering and shows that CRISPR brings us to a new moral precipice.

In "Cutting Eugenics Out of CRISPR/Cas9," Brokowski et al. propose a legal prohibition against germline experimentation, but offer a wide latitude of acceptance for other kinds of research and applications.

John Harris, in “Edited Genes and Slippery Slopes,” addresses the question of whether permitting CRISPR to be used to repair medically abnormal embryos must be viewed by a moral standard that it can lead to other less commendable ends. He questions whether all applications of CRISPR must be judged according to the ethics of the slippery slope.

The fourth paper, titled “Children of Capital: Eugenics in the World of Private Biotechnology,” helps us understand how the early eugenics movement in the United States is critical to our understanding of the issues CRISPR introduces today. Evans and Moreno explore how a CRISPR policy should be framed.

In “Nurturing or Purifying the Human Genome,” Evelyne Shuster explores the editing metaphor and its application to human reproduction. She questions whether medical germline interventions will inexorably result in germline enhancement.

Shobita Parthasarathy, in “Governance Lessons for CRISPR/Cas9,” compares the current ethical quandary with gene editing to that of recombinant DNA in the 1970s. She reminds us that ethics was postponed in the historical debates and now must be faced in an effort to manage gene editing..

REFERENCES

1. Haldane JBS. Science and ethics. Conway Memorial Lecture. London: Watts & Co., 1928.

Guest Editor:

Sheldon Krimsky
Lenore Stern Professor of Humanities & Social Sciences
Tufts University,
Medford, MA