

# The global influence of genetic engineering on the entire world

[Science](#), [Agriculture](#)



Global warming, nuclear winter, microscopic black holes—society views all these as apocalyptic phenomena resulting from the accelerating rate of discovery in the fields of science and technology. Opinions on fields like climate change and atomic weaponry certainly have a basis in scientific evidence, but many other apocalyptic reactions derive from hypothetical situations and thought experiments. To further examine public opinions on scientific fields, we can examine genetic engineering (GE). The possibilities of GE have prompted many ethicists to provide commentary on the topic, opening a dialogue between policy and experimentation in order to address topics such as genetically modified crops and genetic enhancement in humans. Like any technology, GE has risks and benefits, but in this case, some believe the risks far outweigh the benefits and that forward progress must be stopped.

Scientists define GE as “ the artificial recombination of [DNA] in the test tube, their insertion into a... vector system, and the subsequent incorporation of the chimeric molecules into a host organism in which they are capable of continued propagation... usually [involving] the production of novel genetic combinations by biochemical means” (Mulligan). Using various techniques, scientists can splice DNA from one organism and place it into another in order to give the DNA recipient desirable characteristics. GE gives scientists an unprecedented amount of control over nature—although breeding has allowed humans to slowly weed out undesired traits, it operates at a much slower pace and only for macroscopic organisms. The control that GE gives scientists allows them to manipulate species of any size and create organisms highly unlikely to occur in nature.

Ron Epstein, Research Professor at the Institute for World Religions, expresses many concerns over the use of this new power, fearing a lack of foresight among the scientific community. Aside from obvious concerns for the use of GE in biowarfare, he focuses on the impact of genetically modified organisms (GMOs) on ecological systems worldwide. “ When genetically engineered crops are grown for a specific purpose, they cannot be easily isolated both from spreading into the wild and from cross-pollinating with wild relatives...The genetically engineered plants can then force out plant competitors and thus radically change the balance of ecosystems or even destroy them” (Epstein). In the case of GE crops, more food might be grown in the short term, but the modifications could cause dangerous side effects when the crops are consumed. Although GMOs may be created for altruistic reasons, we may be unable to see their downsides until damage becomes irreversible. In order to harness the positive sides of GE while incurring minimal risk, “ efforts need to be redoubled not only in the area of scientific risk assessment, but also in developing broad ethical guidelines” (Epstein).

Although ethicists address the use of GE in nature, they primarily concern themselves with the use of GE in humans. Through genetics, elimination of genetic disorders becomes possible with technologies such as prenatal genetic screening and gene therapy. However, the possibility of genetic enhancement also exists, in which parents choose embryos based on their traits, such as eye color, athletic ability, and IQ. If people begin to use GE for this purpose, George Will of the Jewish World Review suggests that “ procreation will become manufacture, children will become artifacts, identity

and individuality will become confused and parents will become despots,” and even more, “ biology might do [end the human story] more gradually than [nuclear explosions] can, but no less decisively, and even more repugnantly.” Such intense language results from Will’s definition of humanity as having free will, free will which parents can take away through the use of genetic manipulation.

Directly responding to Will’s article, Harvard Crimson writer Stephen Sachs takes a more logical stance, seeking to avoid the contradiction in treating more familiar medical technologies differently from GE. “ Unless there’s something purposeful about the particular assortment of genes we’re born with, there seems no reason not to change them. We interfere with natural biological processes every time we take an antibiotic...” he says (Sachs). Here, Sachs demonstrates his belief that GE can be treated as just another type of treatment and that it is not inherently wrong, as Will implies with his apocalyptic conclusion. Sachs methodically counters Will’s other arguments as well, stating that GE of humans would not take away free will—thought is independent of physical traits—and that parents would love genetically altered children no less than naturally conceived children. In the end, however, Sachs takes a cautionary stance on GE similar to Epstein’s, though less extreme due to his positive introductory thoughts on GE. Sachs writes, “...there is nothing uniquely apocalyptic about genetic engineering, and we must confront it in the same way we should confront every new development: with our ethics clear and our eyes open.” Readers can see here that Sachs would listen to the points that Epstein discusses, as they

follow a more scientific argument against GE, as opposed to Will's ideological argument.

Contrary to Epstein, Nobel Peace Prize winner and plant pathologist Norman Borlaug uses scientific facts to lend credibility to his goal of showing the safety of GE and the potential that GMOs have on world hunger. Exultantly, he declares, “Imagine the benefits if the genes for rust immunity in rice could be transferred into [other crops]. The world could finally be free of the scourge of the rusts, which have led to so many famines over human history” (Borlaug). In addressing the arguments of the “antiscience crowd” (a use of apocalyptic rhetoric via dualism), Borlaug still cites numbers and facts, including some stating the dramatic increase in crop yields due to the use of biotechnology, while noting that land usage remained the same. He points out that contrary to what environmentalists like Epstein say, biotechnology in this case has prevented “soil erosion and the loss of forests, grasslands, and wildlife that would have resulted had we tried to produce these larger harvests with the older, low-input technology” (Borlaug).

Borlaug continues to counter many other arguments some have against GE. Where Epstein regards traditional breeding methods as safer than GE, Borlaug says that breeding has produced crosses of grass species just like GE might do, generating crops such as bread wheat and maize. We also see contrasts between Borlaug and Epstein in their depictions of scientists' knowledge—Epstein feels that scientists don't consider the outcomes of their GMOs, while Borlaug argues “[scientists] have the insights into plant

genetics and breeding to do purposefully what Mother Nature did herself in the past by chance." Borlaug addresses other points Epstein discussed, from stating the lack of causation between GMOs and human/environmental harm, to declaring that holding back GMOs would hurt more from famine than it would save from unexpected outcomes.

To understand the clashing views of Borlaug and Epstein, readers can examine Harvey Brooks' and Rollin Johnson's comments on ecologists (Epstein's argument) and microbiologists (Borlaug's). They write, " Ecologists readily see nature as fragile, because ecological systems are often interconnected in such a way that small disturbances can be magnified... many of the phenomena [microbiologists] study are common to all living organisms, and so the behavior of particular systems can often be extrapolated..." (Brooks and Johnson 273-274). In this context, readers can see that Epstein's experience in philosophy correlates with ecologists' mindset, leading him to the reasoning that great care should be taken with GE. Meanwhile, Borlaug's experience as a pathologist gives him great confidence in his assessments of GE's risks, explaining his overwhelmingly positive depiction of GMOs.

The professors also provide a spectrum that defines many views in the GE debate. ' Individualists,' like Borlaug, believe that " competitive enterprise and ingenuity can always surmount constraints imposed by nature." ' Hierarchists,' like Sachs, do not view nature as controllable as ' individualists' do, but they still believe in the power of expertise in attempting to overcome natural constraints. Meanwhile, ' egalitarians,' like

Epstein, see GE as a potentially oppressive technology, and feel that it must be controlled lest the balance of nature be destroyed. Finally, Brooks and Johnson propose a final grouping, 'fatalists,' who believe that nature cannot be controlled, "because it is essentially random and unpredictable" (269-270).

Generally, 'fatalist' views of GE are attributed to religious fundamentalists such as Greg Ciola. Contrary to the methodology of the previous authors, Ciola chooses a religious argument as the basis for this anti-GE stance. Ciola cites several passages from the Bible that show God's adamance against the mixing of different species, including the following: "'Thou shall not sow thy vineyard with diverse seeds: lest the fruit of thy seed which thou has sown, and the fruit of thy vineyard be defiled...' (Deuteronomy 22: 9-11)" (Ciola). Ciola uses no scientific facts in his argument, instead relying on his interpretations of the Bible and the negative associations of "playing God" to get his point across. Further Biblical passages he examines give the piece an apocalyptic tone, suggesting that Noah's flood occurred as a result of something similar to GE and that some divine cataclysmic event may occur to cleanse the world of GMOs.

Arguing for "a systematic decision 'algorithm' or 'coordinated framework' for determining eligibility for either regulation or exemption," Brooks and Johnson take a hierarchist view of nature as affected by GE (Brooks and Johnson 268). With such a system, entire categories of products and experiments deemed harmless based on past experience and knowledge could be approved, leaving time to examine more risky or controversial

ideas. Additionally, they assert that this system would strike a good balance between excessive caution, which prevents the beneficial products of GE from reaching society, and 'full speed ahead,' which could lead to great amounts of damage to nature and human life. Brooks' and Johnson's opinions show a balanced and objective viewpoint, best suited for serving as a foundation for further discussion, unlike the more biased positions of authors such as Will, Ciola, and Borlaug.

Examining each writer's piece, readers can see that arguments for or against GE tend to use primarily ideological rhetoric, as in Will and Ciola, or scientific facts, as in Epstein, Sachs, Borlaug, and Brooks and Johnson. Those using ideological rhetoric seem to be opposed to GE because of its strangeness, as noted by Sachs: "...moral theory should be more than a summation of the circumstances under which one gets the willies. Genetic engineering is indeed 'inhumane' if we think only of those things to which humans have historically been accustomed..." Such unfamiliarity engenders fear and negative apocalyptic rhetoric pronouncing the coming end of the world. Scientific arguments, on the other hand, can be used to show the safety or the riskiness of GE. Regardless of an individual writer's stance, scientific arguments, citing everything from historical precedent, analogues, to pure data, lend a great amount of credibility to the debate. The logical approach also prevents Epstein, Sachs, Borlaug, and Brooks & Johnson from sounding apocalyptic as well, leading them all to a general conclusion best stated by Brooks & Johnson: "[separating] concrete decisions from overarching philosophical views of the world and of technology, and hence to focus on



the possible implications of specific decisions in specific circumstances” (Brooks and Johnson 280). GE should not be treated as one technology; rather it is the connection between many technologies and potentials, each of which must be evaluated individually.

After evaluating the thoughts of many writers, we can clearly see that GE has no more of an apocalyptic nature than any other recent scientific development—most fears in fact arise from misconceptions and a lack of precise scientific knowledge on the subject. Despite efforts of scientists to educate the public, GE still remains a highly contested and controversial topic. Because such controversies ignite the imagination, many have authored creative responses to GE, including novels such as *Brave New World* and films such as *Gattaca*. By analyzing these pop-culture media, we can look at how the public response to GE has changed as more discoveries have been made and more information was disseminated, and perhaps determine the best method for garnering public acceptance of GE.

### **Works Cited**

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