

Genetic Technologies

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7.7 Concerns about DNA Technology

Although DNA technology has been the source of great excitement, it has also given rise to serious concerns. Could scientists accidentally release a deadly bacteria or virus? Are GM plants and animals safe to eat? Are GM crops damaging the environment and giving rise to dangerous “superweeds”? Also, which DNA technologies could one day be applied to humans, and what impact will this have on our society and culture? Finally, who will have access to DNA technologies?

Some genetically engineered bacteria and viruses are dangerous to human health or natural habitats. To help keep these organisms from leaving the lab, scientists give them genetic mutations that prevent them from performing important natural functions. This makes it harder for them to survive in the wild. (In the lab, scientists keep them alive by providing conditions that make up for the genetic deficiencies.) Despite these precautions, accidental releases remain a legitimate concern.

Genetically modified crops are probably the most controversial product of DNA technology today. In the United States, GM crops are very common. In 2014, more than 90% of the soybeans, cotton, and corn planted was of genetically modified varieties. In many European countries, however, GM crops are banned or strictly controlled.



FIGURE 7.13

Are genetically modified foods safe? Should they be labeled? Some people, including these protestors in San Diego, California, think that additional regulation is needed.

One basic question is, are GM plants safe to eat? In 2010, the European Commission reviewed 25 years of research and concluded that GM plants are not riskier for human health than plants produced through conventional breeding methods.



However, scientists and consumer groups worry that safety is not always adequately tested. In 2009, a group of two dozen scientists from public research institutions in 17 states warned the U.S. Environmental Protection Agency that the companies that develop GM plants routinely act to “inhibit public scientists from pursuing their mandated role on behalf of the public good” and that these companies had made independent analyses of GM crops impossible.

A related issue is the labeling of GM foods (Figure 7.13). Labeling is not currently required in the United States, although a large majority of consumers favor it. Labeling is opposed by industry, which believes that consumers may avoid products that are labeled.

Environmental concern

Another concern about GM crops is their effect on the environment. For example, crops that contain *Bacillus thuringiensis* genes, which are toxic to pest species, can also kill nontarget species. “Roundup Ready” crops encourage farmers to use more chemical herbicides, which damage the environment. Some weeds can also evolve resistance, becoming “superweeds.” Roundup has also been linked to the decline of honeybee populations. A 2018 study found that the herbicide Roundup makes honeybees vulnerable to deadly infections by harming the beneficial bacteria in the honeybees’ guts.

Contamination

A further worry is contamination by genetically engineered plants or their genes. In a 2007 test of “Roundup Ready” creeping bentgrass, developed for use on golf courses, some plants escaped from a field in Idaho and ended up in irrigation canals miles away in Oregon. Hundreds of escaped plants were found, including many that had already produced their own seeds. GM crops could also breed with wild plants and transfer their herbicide-resistance genes to the wild varieties, creating instant “superweeds.” One such plant, a resistant mustard weed, was discovered in 2005 in a field used for trials of GM oilseed rape (a plant used to produce canola oil). Before the discovery, such transfers were described as nearly impossible.

Genes from GM crops can also contaminate traditional crops. In 2004, the Union of Concerned Scientists studied corn, canola, and soybeans and found that the traditional seed supplies for all three were contaminated with DNA from genetically modified varieties. Contamination is a particular worry for organic farmers because organic produce cannot include GM varieties. In 2011, an organic farmer in Australia sued his neighbor after GM canola blew onto his fields, resulting in the loss of his organic license.

Cost

A final concern about GM crops is cost. GM seeds are too expensive for farmers in many parts of the world. In India, many farmers were encouraged to take out large loans to buy “insect-proof” GM seeds. When the crops failed due to drought (some GM crops require more water than traditional crops), many of the farmers went bankrupt.

What about DNA technology and human society? What will happen when we apply DNA technologies to ourselves? Curing a genetic disease is one thing, but what about enhancing our abilities? Should constraints be placed on DNA technology? In addition, as genetic technologies are developed, who will control access to them? Should important technologies be available only to the wealthy and privileged? When a private company began to clone cats for people who missed their deceased pets, for example, the price tag was \$50,000.



On the other hand, could the ability to manipulate DNA become too readily available—in easy, do-it-yourself kits? Will we have enough time to think through the social and ethical implications of a technology or to legislate effective controls? And what if something unexpected occurs? We will be facing questions like these for years to come. So that our answers to these questions can be based upon understanding rather than ignorance, it's upon each of us to become familiar with the basic biology concepts underlying genetic engineering.

READING CHECK

Is there evidence that some genetically modified crops could be harmful to species in natural environments?

CHECK YOUR ANSWER

Yes, in some cases. Crops that contain *Bacillus thuringiensis* genes, which are toxic to pest species, can also kill nontarget species. “Roundup Ready” crops encourage farmers to use more chemical herbicides, which damage the environment. And Roundup has also been linked to the decline of some honeybee populations.

For more on genetic engineering and potential controversies, you can check out this YouTube video:

https://www.youtube.com/watch?v=FY_ZUEKWhBc

