

SC.912.L.16.10	Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.	High
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Biotechnology has both positive and negative effects on individuals, society, and the environment. One topic of current debate is controversy over the risks and benefits of genetically modified crops. Today, genetic engineers can add favorable characteristics to a plant by manipulating the plant's genes. Genetic engineers can change plants in many ways, including making crop plants more tolerant to drought conditions and creating plants that can adapt to different soils, climates, and environmental stresses. Many people, including influential scientists, have expressed concern that genetically modified crops (GM crops) might turn out to be dangerous. Scientists, the public, and regulatory agencies must work together to evaluate the risks and benefits of GM products.

What kind of unforeseen negative effects might —improved GM crops have? Some food crops, such as corn and soybeans, have been genetically rendered resistant to glyphosate, a weed killer that is harmless to humans. Glyphosate, when used on a food crop, will kill the weeds but will not harm the GM crop, thus increasing food crop yields. Some scientists are concerned that the use of GM crops and the subsequent use of glyphosate will eventually lead to glyphosate-resistant weeds. This will leave farmers with few weed-control alternatives. Some GM crops have genes added to improve nutritional character, as was done in rice. It is important to check that consumers are not allergic to the product of the introduced gene. For this reason, screening of GM crops for causes of allergy problems is now routine.

Are GM crops harmful to the environment? Will introduced genes pass from GM crops to their wild or weedy relatives? This sort of gene flow happens naturally all the time, so this concern is legitimate. For most crops, no closely related wild plant is around to receive the gene. The GM gene cannot pass to a non-relative, because crop plants cannot successfully reproduce with unrelated species, any more than a cat can breed with a giraffe. There are wild relatives of corn in Mexico and Guatemala, which frequently exchange genes with corn crops. Scientists are divided about whether it makes any difference if one of the genes is a GM gene.

Might pests become resistant to GM toxins? Pests are becoming resistant to GM toxins just as they have become resistant to the chemical pesticides that are sprayed on crops. Some argue that because GM crops might select and promote the competition and survival of pests that are resistant to toxins can mean that GM crops do more harm than good.

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1. Create a vocabulary burrito for the following terms: clone, genetic engineering, genetically modified organism, gene sequencing, genetic screening, gene therapy, Human Genome Project, DNA fingerprint.
2. Some fruits and vegetables are the result of crossing different species. A tangelo, for example, results from crossing a tangerine with a grapefruit. How are the genetic engineering processes of making transgenic organisms similar to and different from crossbreeding?
3. Monsanto, a Biotechnology company which creates genetically modified crops, is currently suing the farmers whose farm land is adjacent to their research laboratories and farm land. The wind is dispersing the genetically modified seeds from the Monsanto laboratories to the surrounding farmers' land. The farmers are then growing and harvesting the new, genetically modified crop.
 - a. Should the farmers be liable for growing Monsanto's patented seeds? Why or why not?
 - b. Should the genetically modified seeds/ fruits be sold to the public? Why or why not?
4. Some bacteria—sometimes called —super bugs—have developed a resistance to certain antibiotics. How does drug resistance develop in bacteria?
 - A. Unsanitary conditions allow all kinds of bacteria to breed, including those that are antibiotic resistant.
 - B. In the bloodstream, different species of bacteria exchange genes and become resistant to antibiotics.
 - C. Mutations in some bacterial genes make the bacteria stronger and better able to defeat the body's immune system.
 - D. In the presence of an antibiotic, bacteria with genes that make them resistant survive and eventually take over the population.

Justify your answer with an SRE

5. Every human begins as a single, fertilized egg. After about five days, a hollow ball has formed that contains about 30 specialized cells called stem cells. Embryonic stem cells can divide endlessly and give rise to every type of tissue in the body. Scientists hope that someday stem cells will make it possible to repair or replace damaged tissues. Embryonic stem cells used in research come from eggs that were fertilized in the laboratory and donated for research. Adult stem cells used in research are found in adult tissues. The use of embryonic stem cells is controversial because a human embryo is destroyed to obtain these cells. However, currently adult stem cells cannot be grown in the lab, and they occur in limited numbers in the body. Currently, large numbers of stem cells are needed for stem cell therapy. How does this fact affect the debate about the two sources of stem cells?
 - A. Embryonic stem cells are readily available but are not thought to be useful for stem cell therapy.
 - B. Adult stem cells are rare, and research needs to be done in order to find techniques to harvest more adult stem cells.
 - C. Embryonic stem cells are rare, and research needs to be done in order to find techniques to harvest more adult stem cells.
 - D. Somatic cells are destroyed during the collection of adult stem cells and there would be too much damage to justify the harvesting of these cells.

Statement	
Reason	
Explanation	