

Investigation & Experimentation

S E R I E S

GENETICALLY MODIFIED ORGANISMS

A CHANGE FOR THE BETTER?

GOAL OF ACTIVITY:

The goal of this activity/exercise is to ensure students understand the larger picture of research involving genetically modified organisms, including controversial forms, approaches, and intents, so they are able to comprehend the potential issues, concerns, importance, liabilities, and benefits.

DESIRED OUTCOMES:

Students will be able to:

- 1) Understand why transgenic animals are useful in biomedical research
- 2) Understand the benefits and controversies of genetically modified organisms
- 3) Understand the agricultural and economic benefits and potential liabilities of genetically modified plants and foods
- 4) Understand the necessity for biomedical research
- 5) Write a concise position statement

PREREQUISITES:

Prior to conducting this exercise, students should have successfully completed California State Board of Education academic content standards in cell biology, genetics, and ecology.

PROCEDURE:

1. Introduce the goal of the activity to the students and briefly discuss the importance of investigation and experimentation.
2. Ask students what they have heard about genetically modified organisms and have them discuss/list the sources of their information.
3. Review the *Societal Statement* by having one student read it aloud.
4. Review the *Key Terms* with students.
5. In order to get the students to make informed decisions based upon facts, ask them if they are concerned about world hunger, water usage, the dangers of agricultural run-off/pesticide use, and effective disease treatment. Record where students stand on these issues and note whether the students believe if the stated problem is a top priority to alleviate or solve in their opinion.
6. Find out what the students know about genetically modified organisms. Ask them whether they are pro or con on the topic. Record the students' positions.
7. Assign each student the task of reading two articles about genetically modified organisms. (The California Society for Biomedical Research and the National Institutes of Health are two sources for articles). The students may wish use their library or an internet search engine to locate other articles of interest. This is also a good opportunity to discuss the importance of obtaining information on the internet from reliable sources.
8. Divide the class into sections and assign one or two key terms to each group to define and report back to the class.
9. After completing their reading assignments and researching definitions, have the students read the definitions assigned to them out loud.
10. Have the students read each of the discussion questions and allow students to respond to the each question. Allow the students to express the pros and cons of their argument.
11. Ask whether any students have changed their minds regarding their opinion concerning the use of genetically modified organisms. If they have changed their opinion, ask the students what made them switch their position.



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SOCIETAL STATEMENT:

Genetically modified organisms represent real solutions to a myriad of problems, many of which have plagued humankind for thousands of years. Each engineered solution that results from work with genetically modified organisms, however, has the potential to generate multiple questions that require additional research. Although some individuals are uneasy about the long-term effects of altering organisms, there can be no denying that this powerful technology can have a positive effect on every man, woman, and child in the world.

KEY TERMS:

- Genetic engineering
- Recombinant DNA
- Genes
- Gene therapy
- Cross pollination
- Disease models
- Transgenic animals
- Genome

FOLLOW-UP ASSIGNMENTS:

1. Have students define the key terms and describe their importance in research involving genetically modified organisms.
2. Have students search for information on research involving genetically modified organisms, and have them to write concisely why such organisms are so important. Students should consider using the Research Questions as a starting point. All references should be properly cited in their paper.
3. Assign students to write a brief position paper addressing the following:
 - a. Their position
 - b. Supporting statements for their position (this will be acquired through researching information on the subject)
4. Potential economic and humanitarian impact of research involving genetically modified organisms.

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STUDENT DISCUSSION QUESTIONS

1. Knowing that a crop could be engineered such that it would be resistant to pests and therefore would not require pesticides, would you consider eating it? Why or why not?
2. If you wouldn't consider eating genetically modified food, would you be opposed to exporting such food to developing countries to alleviate hunger? Why or why not?
3. If crops could be engineered to increase their yield without increasing the amount of water or fertilizer used, would you support providing the technology to assist U.S. allies (third world countries) to enable them to feed their own population?
4. What do you think would happen if enemies of the U.S. were able to develop genetically modified foods?
5. Describe what tests you would require before permitting human consumption of genetically modified food.
6. Do you have any concerns if transgenic animal research produced sheep that were larger and thereby grew more wool?
7. If more effective means of treating your friend's disease could be achieved through the use of transgenic animals, would you be in favor of such?
8. What potential concerns exist should cross-pollination of conventionally bred crops and genetically modified crops occur? What types of precautions do you think should be put in place to prevent cross-pollination?
9. What types of benefits to the environment do genetically modified crops present?
10. What type of economic impact could genetically modified crops present (i.e., frost resistant crops, etc.)?
11. What kinds of national security risks do genetically modified organisms present?
12. What type of impact could genetically modified foods implanted with medicine or vaccines have in third world countries?
13. Are there selected applications of genetically modified organisms that you approve of? Why or why not?

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RESEARCH QUESTIONS

These questions are designed to provide students with a starting point for initiating research, discussion, or debate issues.

1. Name four crops that have been genetically modified by scientists.
2. What are the advantages of genetically modified crops? What are the disadvantages?
3. What four countries produce most of the world's genetically modified crops?
4. What purpose do transgenic animals serve in biomedical research?
5. What are disease models?
6. What countries are unable to produce enough food to feed its population? Do any of these countries possess a population that would benefit from either higher crop yields or vaccines?