FOOD SCIENCE AND TECHNOLOGY
Biotechnology
Grade Levels: 9-12

Concept: Biotechnology

Comprehensive Standard: 6.5 Evaluate the impact of science and technology on food composition and safety, nutrition, and wellness of individuals and families

Technical Standard(s): 6.5.2 Determine how scientific and technological advancements have impacted the nutrient content, availability and safety of foods

LESSON COMPETENCIES

- Define biotechnology and functional foods
- Identify benefits of biotechnology and functional foods
- Explore concerns surrounding biotechnology and genetically engineered foods (including safety, labeling, etc.)

Anticipated Behavioral Outcomes:

- Students research information related to food biotechnology from reliable sources.
- Students continue to search for information related to this emerging nutrition issue and make informed choices based on reliable information

Resources Needed:

- Guthmiller, S., Jacobs, C. and Meyer, L. (2001). Genes by Design: An Educational Resource on Food Biotechnology for High School Students, South Dakota State University Cooperative Extension Service, South Dakota State University, Brookings, SD

References for teachers and students:

West, D.F. (2006). Nutrition and Fitness: Lifestyle Choices for Wellness. Chapter 23, Food and Fitness Trends, Goodheart-Willcox Company, Inc., Tinley Park, IL. www.goodheartwillcox.com

UPDATE A wealth of resources on the topic of biotechnology and other topics are available at the *International Food Information Council Foundation* website at www.ific.org Click on "Food and Nutrition Information". Some articles to review are*:* "Food Biotechnology: Enhancing Our Food Supply, July 2004" (www.ific.org/publications/brochures/biotechbroch.cfm) and the background paper on the topic with links to several websites and articles focusing on food biotechnology titled *Food Biotechnology: Background on Food Biotechnology* (www.ific.org/food/biotechnology/index.cfm). The links include the *American Dietetics Association's* position paper on bioengineered foods and others.

An excellent article, "The good, the bad and genetically engineered", from the January 13, 2000 issue of CNN.com which discusses both the benefits and consumer

concerns related to bioengineered foods is available at www.cnn.com/2000/HEALTH/diet.fitness/01/13/biotech.food.one.wmd/index.html

NEW – The IFIC has a downloadable PowerPoint presentation on Food Biotechnology available for download at www.ific.org/tools/presentations.cfm

NEW – The USDA webpage on "Food Biotechnology" (http://vm.cfsan.fda.gov/~lrd.biotechm.html) has numerous resources.

NEW A WebQuest on this topic, *Dining by Design: Biotechnology and Our Food, Frankenfood?* is available at www.bcpl.net/~sullivan/modules/biotech/

NEW The *MedLine Plus Medical Encyclopedia* at the *MedLinePlus* (http://medlineplus.gov/) website has a definition and brief background paper on genetically engineered foods: www.nlm.nih.gov/medlineplus/ency/article/002432.htm

NEW The *American Dietetics Association* has several articles that provide their position on the issue of food biotechnology, their position paper on the issue is titled, *Agricultural and Food Biotechnology* (www.eatright.org/cps/rde/xchg/ada/hs.xsl/) and another is titled, *Biotechnology and the Future of Food* (www.eatright.org/cps/rde/xchg/ada.hs.xsl.advocacy_3793_ENU_HTML).

NEW The *Council for Agriculture and Science Technology* (CAST) website has a list of links to educational activities and lesson plans for k-12 at www.cast-science.org/cast/src/cast_top.htm

Background Information:

Food biotechnology uses what is known about plant science and genetics to improve food and how it is produced. Genes are responsible for traits like a person's eye color or a vegetable's taste. Using modern biotechnology, scientists can move genes for valuable traits from one plant to another. This way, they can make a plant taste or look better, be more nutritious, protect it from insects, or produce more food ("Food Biotechnology: Enhancing Our Food Supply" www.ific.org/publications/brochures/biotechbroch.cfm from the *International Food Information Council Foundation*, September, 2004)

There are many benefits to consumers as a result of biotechnology; current benefits include ("Food Biotechnology: Enhancing Our Food Supply" www.ific.org/publications/brochures/biotechbroch.cfm from the *International Food Information Council Foundation*, September, 2004):

- disease resistance
- reduced pesticide use
- more nutritious composition of foods
- herbicide tolerance
- more rapid growth of crops
- improvements in taste and quality

Benefits that can be expected in the near future are:

- reducing levels of natural toxins in plants
- providing simpler and faster methods to locate pathogens, toxins and contaminants
- extending freshness

Learning Activities:
High School Level

- Introduce biotechnology with the PowerPoint presentation, Genes by Design (see resources needed) or use the overhead masters available in the curriculum to create transparencies OR use the PowerPoint presentation, "Food Biotechnology" available for download at www.ific.org/tools/presentations.cfm

- Complete the activities outlined in the Genes by Design (see resources needed). Activities include:
  - Biotechnology Timeline
  - The Cut and Past of Genetic Engineering
  - Fruit Cup DNA Extraction
  - Biotech Ice Cream
  - Debating the Pros and Cons of Biotechnology
  - Genes by Design – An Ethics Activity
- Read the article, "The good, bad and the genetically engineered" (http://archives.cnn.com/2000/HEALTH/diet.fitness/01/13/biotech.food.one.wmd.index.html) and the article, "Myths and Facts about Biotechnology" (see reference list) discuss the value of the products being developed by researchers and the concerns that consumers have related to genetically engineered foods.
- Discuss labeling of genetically bioengineered food products.

Extended Learning Activities

- **Interdisciplinary Activities –** hold an open forum or debate with agriculture students promoting the benefits of bioengineered foods and genetically modified products and family & consumer sciences students voicing consumer concerns

Academic Connections - NEW

- ✓ **Speech/Communications** – Conduct a debate on the safety issues surrounding genetically modified foods, specifically the controversy surrounding GMOs in Europe. What are the concerns of the European community? What can US producers do to address their concerns?