

APES ~ BIOENGINEERED FOODS and IRRADIATED FOODS

WHAT TO TURN IN (paper-clip them together):

BIOENGINEERED FOOD BOOKLET
IRRADIATED FOODS TRUE-FALSE QUIZ, GRADED
IRRADIATED FOODS SIGN/MINI-POSTER

PART 1: BIOENGINEERED FOODS

Proposed Rules Issued for Bioengineered Foods

Excerpts of an article by Raymond Formanek Jr.

Bioengineered Foods

The shelves of just about every American supermarket are lined with foods that have been genetically altered to improve the product's taste, shelf life, or resistance to insects and other pests. Tomatoes, potatoes, squash, corn, and soybeans have been genetically altered through the emerging science of biotechnology. So have ingredients in everything from ketchup and cola to hamburger buns and cake mixes.

Most of the foods we eat today are the result of crossbreeding--a technique that relies on the laws of inheritance first described by Gregor Mendel in the 19th century--to obtain desired characteristics. Crossbreeding is inexact. It also involves trial-and-error and lots of time. Although biotechnology is a more efficient way to introduce new traits, there are concerns. Some worry about the possibility of introducing new allergens into foods. Others worry about the potential effects that altered crop species may have on wildlife and other plants.

However, many researchers say the ability of biotechnology to isolate and introduce a specific gene or just a few genes makes outcomes more predictable, including the ability to predict risks. Supporters say that biotechnology is a tool that allows scientists and farmers to reduce damage from pesticides, boost crop yields, and improve flavor, texture and nutritional content.

"No Known Dangers"

Broadly speaking, growers have been selecting certain beneficial characteristics such as faster growth or sweeter fruit since our nomadic hunter ancestors began to cultivate crops thousands of years ago. Virtually every domesticated crop plant species today differs greatly from its original, wild form due to human intervention.

Companies seeking to market any bioengineered food product conduct studies to show that the new food is as safe as its conventionally crossbred counterpart. The FDA has determined that normal safety and quality control practices used by plant breeders, such as chemical analyses and taste testing, generally are important. Nutritional and other tests also are done to provide additional safety assurances. Bioengineered foods actually are regulated by three federal agencies: the FDA, the Environmental Protection Agency (EPA), and the United States Department of Agriculture (USDA).

The Federal Food, Drug, and Cosmetic Act gives FDA the authority to regulate all foods, food ingredients, and animal feeds derived from crops, including plant varieties developed through biotechnology. The USDA's Animal and Plant Health Inspection Service monitors genetically engineered plants for potential risks to the agricultural environment. The EPA regulates pesticides--including those introduced into plants through biotechnology.

A federally funded study by the National Research Council released in 2000 concluded, "There is no evidence suggesting that bioengineered food is unsafe to eat." The study also found that there is "no strict distinction" between the health and environmental risks posed by genetically engineered plants and those developed through conventional crossbreeding.

Bioengineered foods will not solve all of the world's nutritional and agricultural problems. However, the techniques used to develop them likely will play an important part in boosting food production, improving nutrition, and reducing the needs for herbicides and pesticides.

DNA: The Root of Biotechnology

The discovery that deoxyribonucleic acid (DNA) was a sort of biological "software" in the mid-1950s set the stage for today's bioengineered foods, pharmaceuticals, transgenic animals, and gene therapy. DNA molecules contain the genetic information necessary for life. This information is contained in four chemical bases: adenine, cytosine, guanine and thymine. Specific chunks of DNA that carry the codes necessary for the production of a specific protein are called genes. These proteins contribute to the expression of a specific trait by stimulating biochemical reactions, or by acting as structural or storage units of a cell.

The fact that DNA is a genetic building block in all organisms makes it possible to insert a gene or genes into plants instead of relying on cross-pollination. The inserted gene, called a transgene, may come from an unrelated plant, or even from bacteria, viruses or animals.

For example, scientists have developed a variety of rice capable of synthesizing beta-carotene, a precursor to vitamin A, by inserting genes from a soil bacterium and two genes from a daffodil. Although it's the staple food for half the world's population, rice is a poor source of many essential nutrients and contains no vitamin A. The genetically engineered rice someday could help millions of people worldwide who suffer from vitamin A deficiency, a condition that leads to blindness in a quarter million children annually in Southeast Asia.

A Long-Running Debate

The debate over genetically engineered plants began almost as soon as scientists learned to directly alter the genes in plants in the early 1980s. Opposition to bioengineered foods has been especially strong in Europe and Japan. Concerns include ethical issues related to potential long-term health effects of eating bioengineered foods, labeling, and potential environmental risks. The FDA has reviewed all new bioengineered foods brought to market and has found no reason to believe that they could pose any threat to health.

Grocers began selling the "Flavr Savr" tomato--the first genetically altered food product to enter the U.S. food supply--in 1994. The Flavr Savr ripened slower, could remain on the vine longer, and was expected to provide better quality than other tomatoes available in winter. Experiments are now under way to develop tomatoes that have enhanced levels of lycopene, a plant chemical that gives tomatoes their red color. Researchers say lycopene also may offer health benefits due to its apparent antioxidant properties.

Antioxidants are thought to neutralize harmful molecules in the human body called "free radicals." These substances, which result from cell metabolism and other causes, may contribute to cancer and cardiovascular disease.

Many genetic modifications have been designed to improve production. About half of the soybeans and about 25 percent of the corn grown by farmers in the United States have been bioengineered, according to the USDA. Most of these transgenic crop varieties have been designed to either better tolerate herbicides or resist insects without the need for extensive spraying of pesticides. An estimated two-thirds of the processed foods in U.S. supermarkets contain genetically engineered corn, soybeans or other crops.

Biotechnology also has the potential of creating major advances in medicine. Scientists are looking into the possibility of producing bananas that contain vaccines against cholera, hepatitis B and diarrhea. Some researchers say that food-based vaccines could be especially useful in developing countries because the costs associated with refrigeration and needle sterilization would be greatly reduced or eliminated.

StarLink Corn Investigation and Recall

In September 2000, a consumer group reported that a bioengineered variety of corn not approved for human consumption had been found in taco shells. The corn, dubbed StarLink, was

modified to contain a gene from the bacterium *Bacillus thuringiensis* that expresses a protein--Cry9C--toxic to certain insects that eat up the profits of corn growers.

The Environmental Protection Agency (EPA) is responsible for reviewing the safety of pesticide substances in bioengineered plants. The EPA approved Cry9C only for corn earmarked for animal feed and industrial uses. The agency did not approve the protein for human consumption due to lingering questions about Cry9C's potential to cause allergic reactions.

Although StarLink's developer, Aventis, was required to ensure that the bioengineered corn did not go into food, some became mingled with corn destined for human consumption. The presence of an unapproved pesticide in food means that the food is adulterated under the Federal Food, Drug, and Cosmetic Act, enforced by the FDA.

Upon learning of allegations that the taco shells contained StarLink corn, FDA began a full investigation. Kraft Foods, producer of the taco shells, initiated its own investigation and voluntarily recalled millions of taco shells as soon as an independent laboratory found that the shells contained the Cry9C gene. The FDA subsequently confirmed the presence of StarLink in the taco shells.

Other recalls have resulted from FDA's continuing StarLink investigation. The agency has worked with EPA and the U.S. Department of Agriculture (USDA) to ensure that corn products containing the Cry9C gene are limited to approved uses. Aventis agreed to buy back the 2000 StarLink crop.

BIOENGINEERED FOODS BOOKLET

After reading the article and checking online for additional information, create a booklet to educate people about the pros and cons of bioengineered foods.

Criteria:

- Use plain paper. You can fold one piece of paper for the booklet or staple multiple sheets.
- Have a cover page, and one page for at least three pros and one page for at least three cons.
- Use color, and embellish as desired.
- Cite all sources.
- Put your name on the back page.

PART 2: - IRRADIATED FOODS ~ Quiz and sign or mini-poster

1) Before you read the information on the next pages, take a **TRUE-FALSE QUIZ** on loose leaf paper. You will be credited by participating, not on how many you get right.

IRRADIATED FOODS QUIZ

- 1) *Irradiation is a good substitute for proper, clean food handling.*
- 2) *Food irradiation is outlawed in the U.S.*
- 3) *Food irradiation is not supported by the American Medical Association.*
- 4) *Irradiation makes foods radioactive for a short time afterward.*
- 5) *The World Health Organization has campaigned extensively against food irradiation.*
- 6) *Irradiation causes harmful, permanent chemical changes.*
- 7) *Irradiation causes a large loss of nutrients in the food.*
- 8) *Foods that are irradiated can be sold without a label saying so.*

2) Now, grade your quiz answers. (Check the end of the document.)

3) Read the article on the next page.

4) After reading the article and checking for additional information online, construct a mini-poster or sign (see end of document for details).

IRRADIATION AND FOOD SAFETY

(from http://www.fsis.usda.gov/Fact_Sheets/Irradiation_and_Food_Safety/index.asp)

As part of its public health mission to reduce the risk of foodborne illness, the U.S. Department of Agriculture's (USDA) Food Safety and Inspection Service (FSIS) inspects meat, poultry, and egg products, including those that are irradiated. FSIS recognizes irradiation as an important technology to protect consumers. Irradiation of food reduces the numbers of harmful bacteria that may be present in food, including *E. coli* O157:H7, *Salmonella*, and *Campylobacter*.

What is food irradiation?

Food irradiation is a process in which approved foods are exposed to radiant energy, including gamma rays, electron beams, and x-rays. In 1963, the Food and Drug Administration (FDA) found the irradiation of food to be safe. Irradiation of meat and poultry is done in a government-approved irradiation facility. Irradiation is not a substitute for good sanitation and process control in meat and poultry plants. It is an added layer of safety.

Are irradiated foods safe to eat?

Yes. Just as pasteurization makes milk safer, irradiation makes meat and poultry safer by reducing the numbers of harmful bacteria and parasites. Irradiation is an important food safety tool in fighting foodborne illness.

FDA and other public health agencies worldwide have evaluated the safety of irradiation over the last 50 years and found it to be safe. Irradiation has been endorsed by the American Medical Association and the United Nations' World Health Organization. In 37 countries, more than 40 food products are irradiated. In some European countries, irradiation has been in use for decades.

The sources and amounts of energy that can be applied to foods have been approved by the FDA and are not strong enough to cause food to become radioactive. Scientific studies show that food irradiation does not significantly change the nutrient content, flavor, or texture of food.

What foods are irradiated?

Fresh meat and poultry including whole or cut up birds, skinless poultry, pork chops, roasts, stew meat, liver, hamburgers, ground meat, and ground poultry are approved for irradiation. U.S. food regulations also allow the irradiation of wheat and wheat powder, white potatoes, many spices, dry vegetable seasonings, fresh shell eggs, and fresh produce.

How will I know if meat and poultry products are irradiated?



The international symbol for irradiation, the radura, must be on packages if the entire product was irradiated, as well as the phrase, "treated by irradiation" (or "with irradiation"). The radura, pictured here, can be any color. This required labeling gives consumers the option to choose between irradiated and non-irradiated meat and poultry.

If irradiated meat is used in another product, such as pork sausage, then the ingredients statement must list irradiated pork, but the radura does not have to appear on the package.

Restaurants are not required to disclose the use of irradiated products to their customers; however, some restaurants voluntarily provide irradiation information on menus.

How should I handle irradiated meat and poultry?

Irradiation does not replace safe cooking and handling. You should always follow the four safe food handling steps:

- **CLEAN.** Wash hands, surfaces, and utensils often.
- **SEPARATE.** Don't cross-contaminate.
- **COOK.** Cook food to a safe internal temperature. Check the temperature with a food thermometer.
- **CHILL.** Refrigerate or freeze within 2 hours.

IRRADIATED FOODS SIGN or MINI-POSTER

Compose a mini-poster or sign about irradiated food.

General criteria:

Use one plain sheet of paper.

NO WORDS may be used, except for your name on the back.

Numbers may be used.

The following information must be conveyed:

what is food irradiation

what types of foods are irradiated

how it is regulated

labeling

safety issues

(Quiz answers: all FALSE!)