In addition, the resistant enzyme is present at very low levels and it is as easily digested as the normal plant enzyme.

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.

Medicinal value of Bioengineered food

Biotechnology also has the potential of creating major advances in medicine. Plants may become miniature "factories" for pharmaceuticals through genetic engineering. Scientists are growing plants that produce antibodies to help fight cancer, heart disease and tooth decay. And researchers are experimenting with growing fruits and vegetables that contain vaccines for measles, hepatitis B, Norwalk virus, diarrhea, cholera and more. These edible vaccines could be pureed into an applesauce-like consistency and fed to children and adults alike. They could be produced in larger quantities and at less expense than current vaccines.

·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.

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·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.

The debate over genetically engineered plants

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 and potential environmental risks. Some worry about the possibility of introducing new allergens into foods such as those found in peanuts, wheat and soy. Others worry about the potential effects that altered crop species may have on wildlife and other plants. All of the proteins that have been placed into foods through the tools of biotechnology that are on the market are nontoxic, rapidly digestible, and do not have the characteristics of proteins known to cause allergies. 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. DNA is present in all foods and its ingestion is not associated with human illness. Some have noted that sticking a new piece of DNA into the plant's chromosome can disrupt the function of other genes, crippling the plant's growth or altering the level of nutrients or toxins. These kinds of effects can happen with any type of plant breeding--traditional or biotech. If the plant looks normal and grows normally, if the food tastes right and has the expected levels of nutrients and toxins, and if the new protein put into food has been shown to be safe, then there are no safety issues. 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.

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. It is important to know that bioengineering does not make a food inherently different from conventionally produced food and the technology doesn't make the food more likely to cause allergies.

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