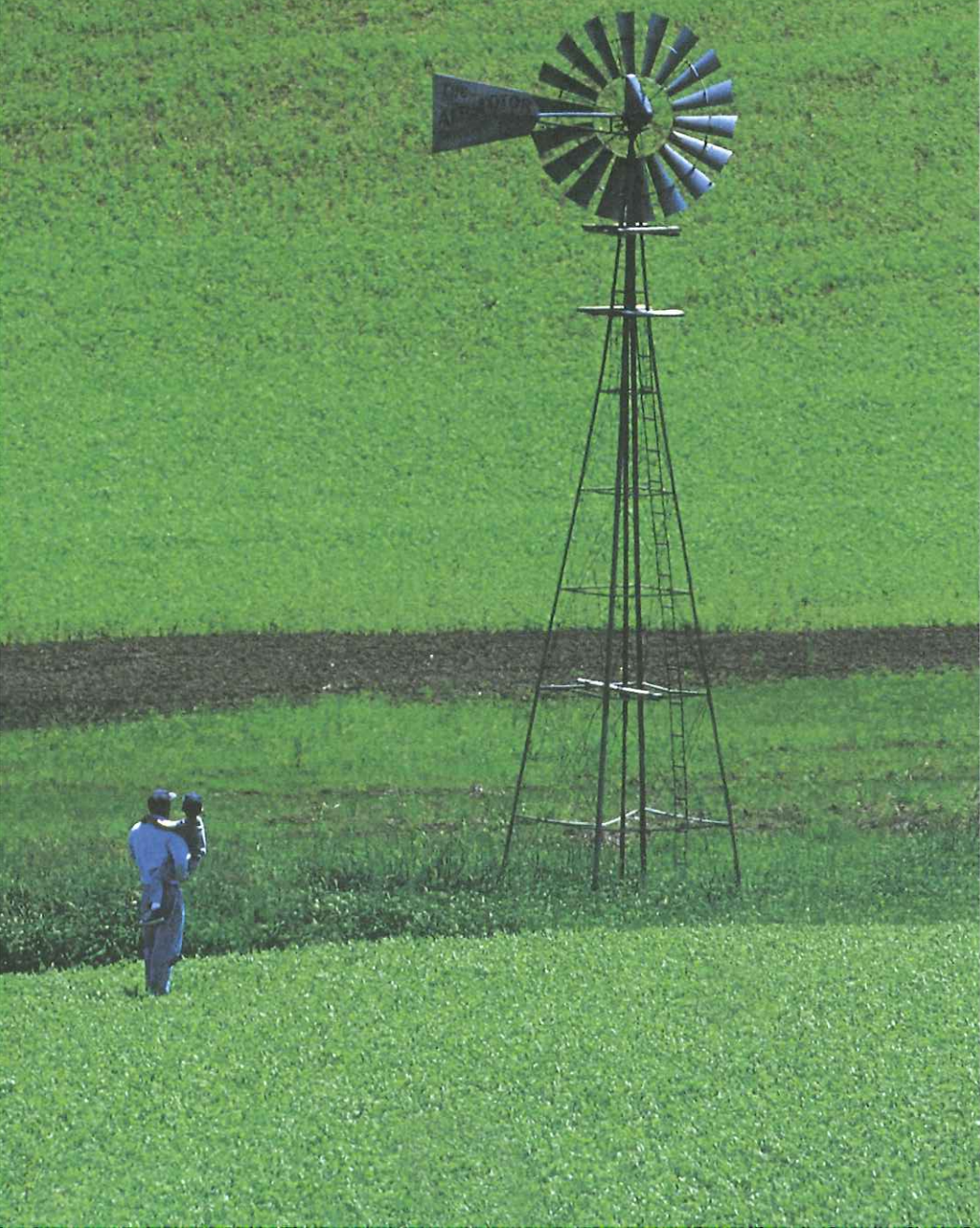


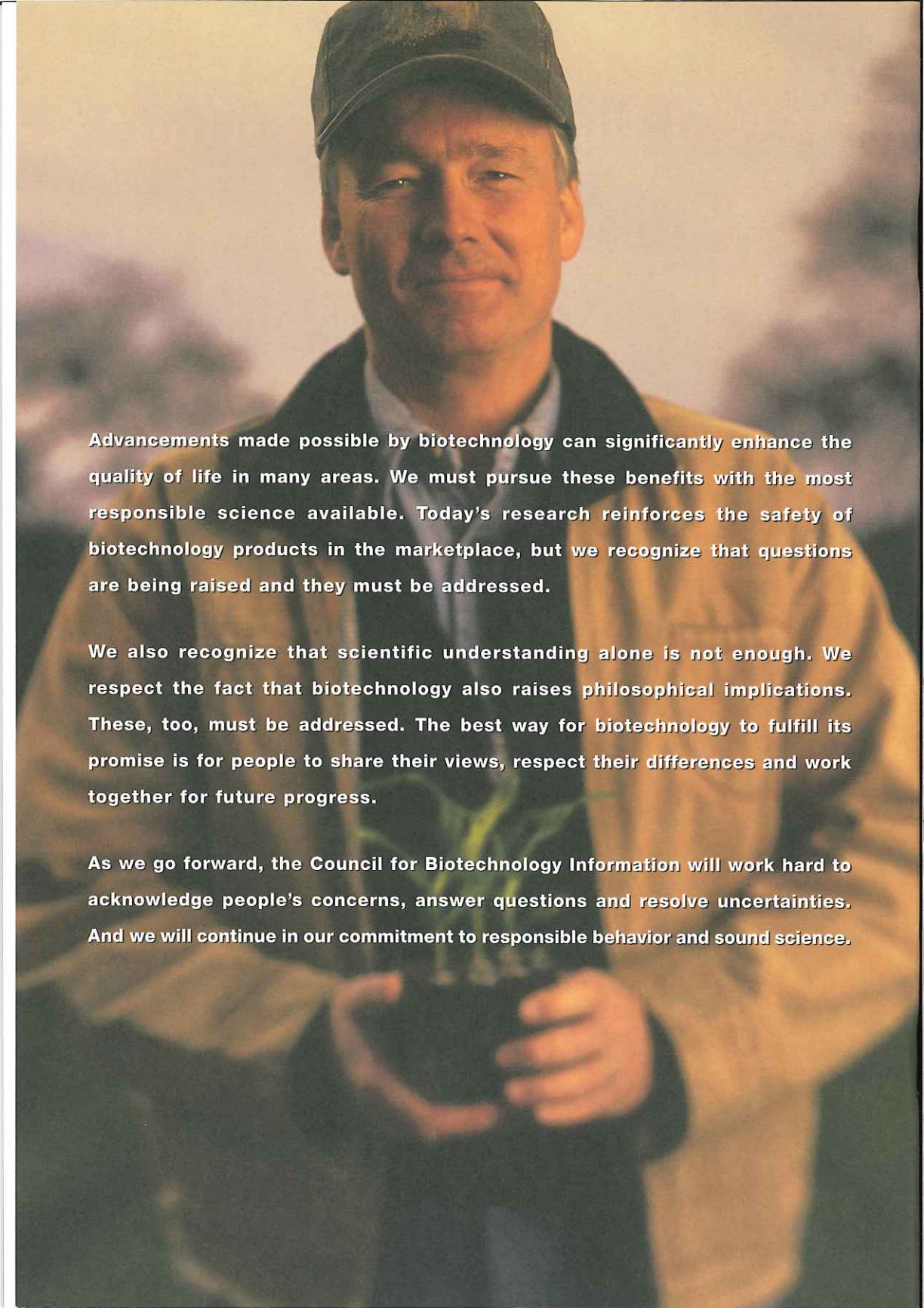
2000

Biotechnology

# Good Ideas Are Growing





A man wearing a dark cap and a light-colored jacket is holding a small green plant in a black pot. He is looking directly at the camera with a slight smile. The background is a soft-focus outdoor scene with trees and foliage.

Advancements made possible by biotechnology can significantly enhance the quality of life in many areas. We must pursue these benefits with the most responsible science available. Today's research reinforces the safety of biotechnology products in the marketplace, but we recognize that questions are being raised and they must be addressed.

We also recognize that scientific understanding alone is not enough. We respect the fact that biotechnology also raises philosophical implications. These, too, must be addressed. The best way for biotechnology to fulfill its promise is for people to share their views, respect their differences and work together for future progress.

As we go forward, the Council for Biotechnology Information will work hard to acknowledge people's concerns, answer questions and resolve uncertainties. And we will continue in our commitment to responsible behavior and sound science.

## Good Ideas Are Growing

Biotechnology is becoming an important tool that can improve our quality of life in many ways, both now and in the future – from life-saving medicines to more nutritious foods.

Discoveries in biotechnology allow for some key crops to have their own protection against insects and disease and, therefore, they can be grown using less crop protection chemicals. For example, cotton and corn now can resist some destructive insects on their own. This allows farmers to choose the best combination of tools to control harmful pests and diseases.

Through biotechnology, a beta-carotene- and iron-enriched “golden” rice is being developed. This may help give young children in developing countries the vitamin A their bodies need to help prevent serious vision problems or blindness, and sufficient iron to help prevent iron-deficiency anemia.

Besides foods, biotechnology is bringing breakthroughs in health care. Since the initial production of human insulin to better treat diabetes, biotechnology continues to create more effective drugs and vaccines. These medicines benefit hundreds of millions of people worldwide who suffer from devastating diseases such as heart disease, cancer, diabetes, Parkinson’s, Alzheimer’s and AIDS.

And in the future, some applications of biotechnology will be used to make materials such as fibers for clothes from “renewable” resources like corn. Other applications will help reduce our dependence on oil and natural gas and could reduce water and energy use by as much as 50 percent.

Among the many uses of biotechnology, food and agriculture applications are understandably of particular interest to society. It is important that quality information be available to the public to assist their understanding and to support effective dialogue and decision making. With this principle in mind, the Council for Biotechnology Information has developed this brochure.

## Benefits of Food Biotechnology

Biotechnology has the potential to deliver significant benefits to:

- **Consumers** who seek better quality, better tasting and more nutritious foods,
- **Farmers** who want more efficient methods to grow crops with less impact on the environment, and
- **Developing countries** seeking solutions to help feed a growing population.

### 1800 BC

Yeast is used to make wine, beer and leavened bread. This is the first time people use microorganisms to create new and different foods.

### 1700s

Naturalists begin to identify many kinds of hybrid plants – the offspring of breeding between two varieties of plants.





### What Is Food Biotechnology?

Food biotechnology covers diverse activities – from the use of yeast in brewing or bread-making to advanced plant-breeding techniques. New developments in biotechnology allow us to identify and transfer the specific gene that creates a desired trait in a plant, and offer a more precise way to produce plants with certain beneficial characteristics – such as greater nutrition.



## Benefits for the Environment

Farmers look for ways to protect their crops from disease, weeds and insects that are safe to use and better for the environment. Many modern farmers use a combination of methods that might include crop protection chemicals, beneficial insects, insect-resistant plants and more efficient farming practices. These are the principles of Integrated Crop Management (ICM), which are being increasingly adopted by farmers worldwide. Biotechnology helps make choices possible and can provide significant environmental benefits that:

- **In some cases, reduce the use of crop protection chemicals, as plants have the ability to protect themselves.** Some plants – including corn, potato and cotton – produce a protein that helps control the larvae of certain harmful insects feeding on the plant.
- **Provide opportunities to decrease soil erosion and greenhouse gas emissions through farming practices that protect the environment.** Some of these new crops require less tilling, helping to preserve precious topsoil and reduce farm runoff into streams and rivers.
- **May one day produce plants that grow under tough conditions.** Biotechnology will help make possible plants that grow and produce food in extreme heat, dry or poor soil, areas of flood and other conditions, and on land once considered difficult for farming.
- **May provide new sources of energy or ways to reduce pollution.** Biotechnology may one day produce plants that make us less dependent on non-renewable resources such as oil and natural gas.

These benefits help make agriculture more sustainable. Sustainable agriculture consists of practices that are environmentally sound, socially responsible and economically viable. This approach contributes to maintaining the quality of life for future generations.

1861

Louis Pasteur develops his techniques of pasteurization, and defines the role of microorganisms – establishing the science of microbiology.

1865

From experiments on pea plants in a monastery garden, Austrian botanist and monk Gregor Mendel, the father of modern genetics, concludes that certain unseen particles (later identified as genes/DNA) pass traits from generation to generation.

"...biotechnology techniques have the potential to be useful in enhancing the quality, nutritional value, and variety of food available for human consumption and in increasing the efficiency of food production, food processing, food distribution and waste management." The American Dietetic Association



## Nutrition, Quality And Taste Benefits

The list of foods enhanced by biotechnology is growing. One of the first plant biotechnology products slowed down the softening process – enabling tomatoes to stay on the vine longer and develop their full flavor instead of being picked green like most tomatoes.

Today, research into numerous other improved food products includes:

- Food crops with higher levels of nutrients that may help reduce the risk of heart disease and certain cancers
- Potatoes with a higher starch content, reducing the amount of oil absorbed during frying – resulting in lighter and healthier french fries and potato chips
- Healthier cooking oils – soybean oil with reduced saturated fat
- Cereals and corn with improved protein quality
- Higher quality potatoes with fewer dark spots



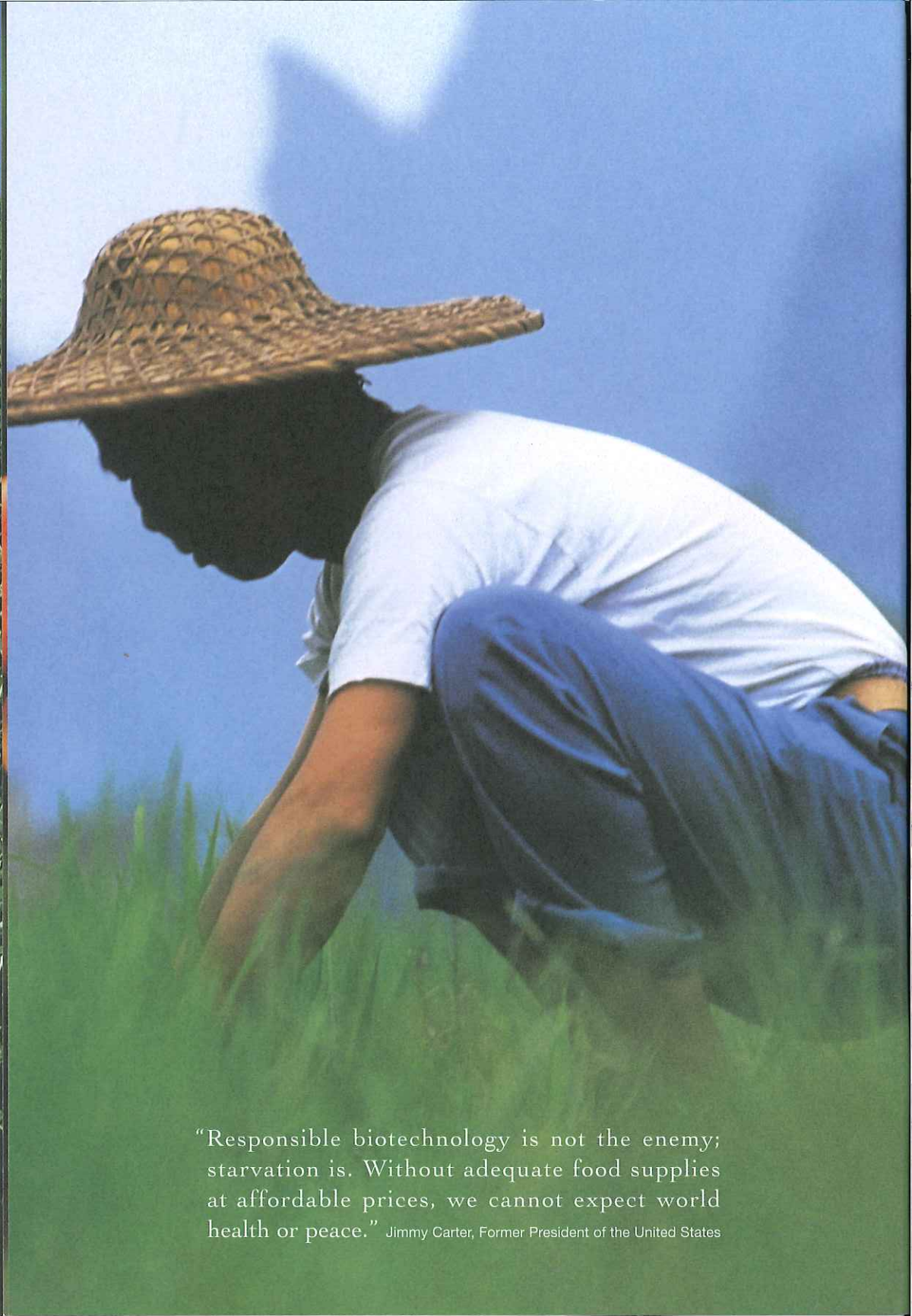
1922

U.S. farmers first purchase hybrid seed corn created by crossbreeding two corn plants. Hybrid corn accounts for a 600% increase in U.S. corn production between 1930 and 1985.

1944

Researchers determine that DNA, present in the nucleus or center of every cell, is the substance responsible for the transmission of hereditary information.





"Responsible biotechnology is not the enemy; starvation is. Without adequate food supplies at affordable prices, we cannot expect world health or peace." Jimmy Carter, Former President of the United States



## Benefits for a Growing Population

The world's population will likely increase to approximately nine billion by 2050. The simple fact is that **with more people, we will need to provide more food**. At the same time, there is little remaining land for farming, without destroying valuable rainforest and wetland habitats. World hunger is a complex issue that biotechnology alone cannot solve. However, it helps. Thanks to developments in food biotechnology, we'll not only be able to grow more food but also better food on land already being farmed.

- The use of biotechnology will provide new ways for farmers to reap more bountiful harvests from existing land, while also sustaining this land's ability to support continued farming.
- Plant diseases can take a devastating toll on food crops in many parts of the world. Biotechnology will arm vital crops such as sweet potato, cassava, papaya, rice and corn with defenses against viruses.
- Insects damage crops in the field and during storage and transportation. Crops with added protection from biotechnology can reduce this damage, improving availability and quality.
- Biotechnology is helping to create rice that contains both beta-carotene, a precursor to vitamin A, and a healthy amount of iron. This product can offer a tremendous opportunity to reduce the risk of childhood blindness – a serious problem in developing countries – and helps prevent iron-deficiency anemia.
- Biotechnology can also help increase a crop's ability to withstand natural environmental factors, such as heat and drought, soil toxicity and floods – improving farming in regions in which food is difficult to grow.



1953

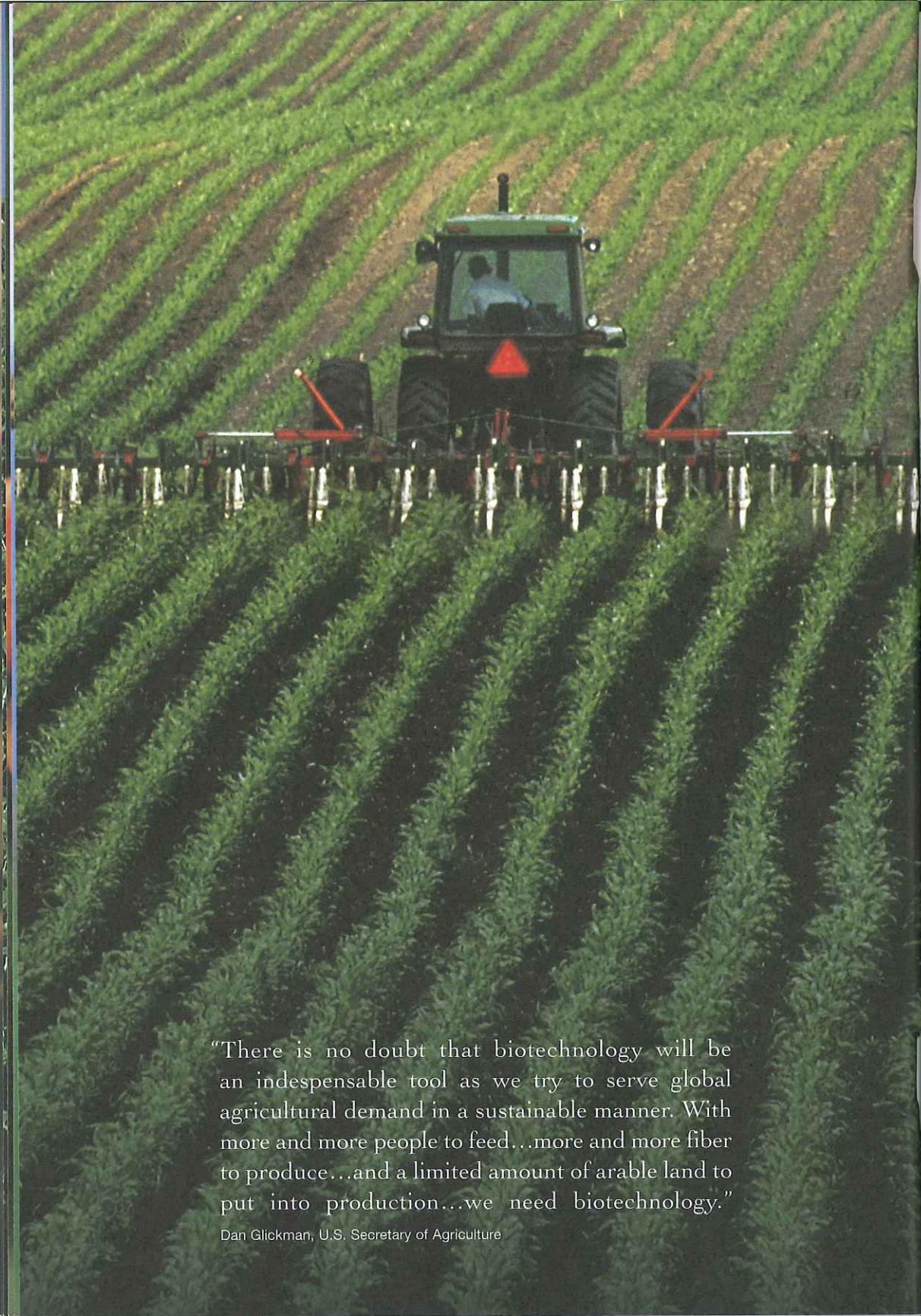
James Watson and Francis Crick discover the code for the double helix structure of DNA, for which they receive the Nobel Prize in 1962.

1970

Norman Borlaug becomes the first plant breeder to win the Nobel Prize for his work on Green Revolution wheat varieties (high yield).

1973

Scientists Stanley Cohen and Herbert Boyer successfully move a gene – a specific piece of DNA – from one organism to another, significantly advancing progress in the technology.



"There is no doubt that biotechnology will be an indispensable tool as we try to serve global agricultural demand in a sustainable manner. With more and more people to feed...more and more fiber to produce...and a limited amount of arable land to put into production...we need biotechnology."

Dan Glickman, U.S. Secretary of Agriculture



## Benefits for Agriculture

Biotechnology can assist in the efficient production of more – and more nutritious – foods in ways that will lessen the impact on the environment. In this way, it helps farmers grow more food and better quality crops.

- Farmers can potentially produce more per acre with some biotech crops than with non-biotechnology crops, which helps conserve land and water. Farms large and small can realize these efficiency benefits.
- Biotechnology reduces the time it takes for plant breeders to develop the plants farmers need to grow better crops.
- Herbicide tolerant soybeans, the first large-scale product produced using modern biotechnology, helps farmers to improve yield and simplify weed control.
- Corn that protects itself against insects also provides safer feed for farm animals because of a reduction of plant diseases that are often associated with insect damage.
- Biotechnology can provide opportunities to decrease soil erosion and greenhouse gas emissions through farming practices that protect the environment. Some of these new crops require less tilling, helping to preserve precious topsoil, use less fuel and reduce farm runoff into streams and rivers.
- The United Nations Food and Agriculture Organization has said that “new technologies – such as biotechnologies – offer a responsible way to enhance agricultural productivity today and in the future.”

Biotechnology has just begun to be used in agriculture and food production. But it **holds real promise** for improving the food we eat in ways that benefit both farmers and consumers.



1982

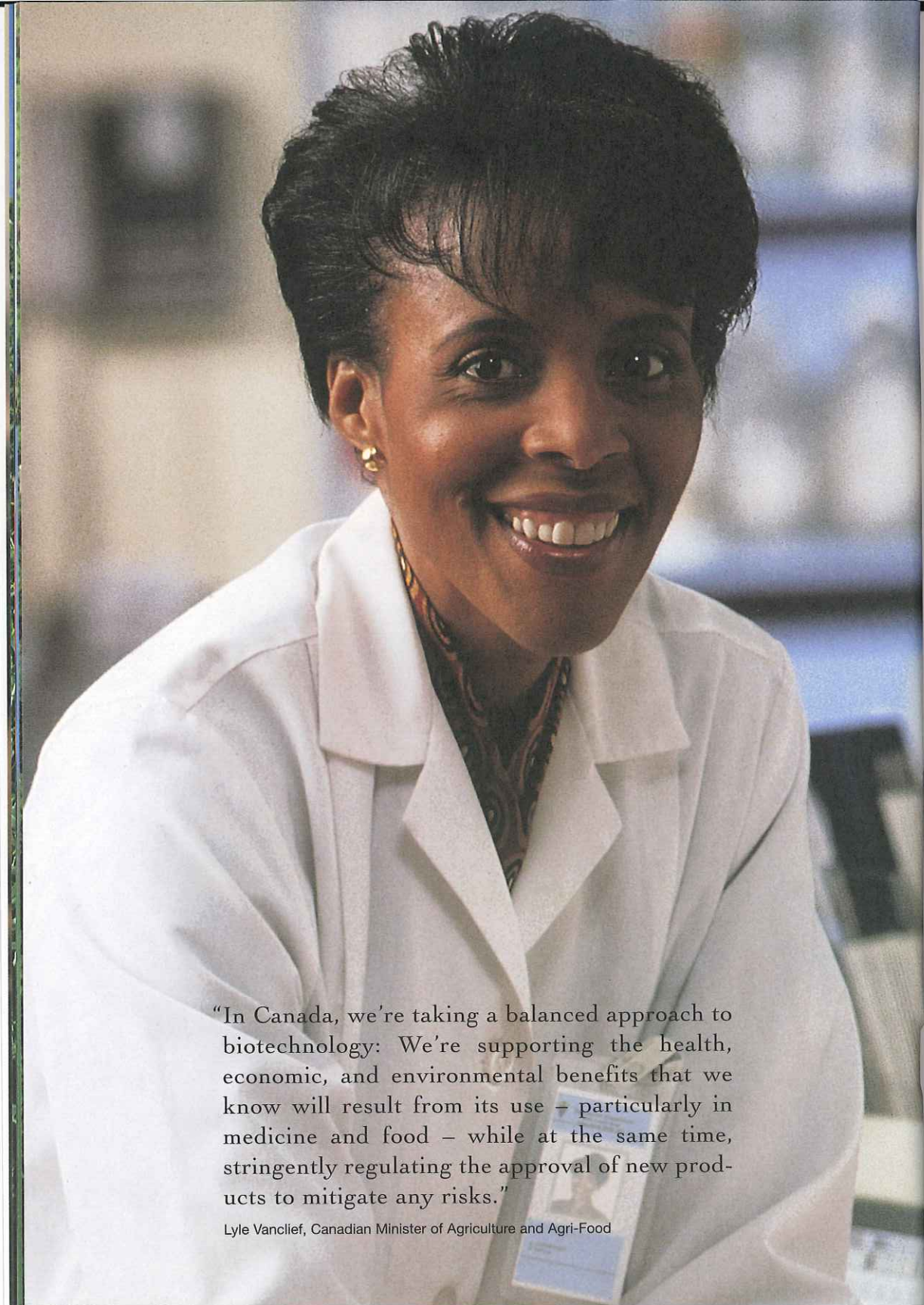
The first commercial application of biotechnology is used to develop human insulin for diabetes treatment.

1983

The first plants are produced using new biotechnology methods.

1990

The first food product modified by biotech – an enzyme used in cheese making – is approved for use in the U.S.



"In Canada, we're taking a balanced approach to biotechnology: We're supporting the health, economic, and environmental benefits that we know will result from its use – particularly in medicine and food – while at the same time, stringently regulating the approval of new products to mitigate any risks."

Lyle Vanclief, Canadian Minister of Agriculture and Agri-Food



## Assuring Safety of Food Biotechnology

Rigorous testing and government review are in place to ensure the safety of these products so that we can realize the benefits of biotechnology. In fact, biotech varieties are tested more thoroughly than conventional crops before they ever come to market. In the United States, three government agencies – the Department of Agriculture (USDA), the Environmental Protection Agency (EPA) and Food and Drug Administration (FDA) – work together to ensure that crops produced through biotechnology are safe. In Canada, safety of foods produced through biotechnology is assessed by Health Canada and the Canadian Food Inspection Agency.

In 1992, the FDA issued a policy concluding that foods derived from biotechnology, as a class, should be regulated the same as any other foods entering the market. The FDA evaluates food biotechnology products on a case-by-case basis. These products are judged on their individual safety and nutrition – not the methods used to produce them.

The same labeling laws that apply to all other foods and food ingredients apply to products of food biotechnology. FDA requires labeling if a food has significant changes in nutritional content, has an allergen or otherwise has changes in the composition or safety of the food.

The use of food biotechnology has been supported by major health organizations, including the American Medical Association (AMA) and the American Dietetic Association (ADA).



1992

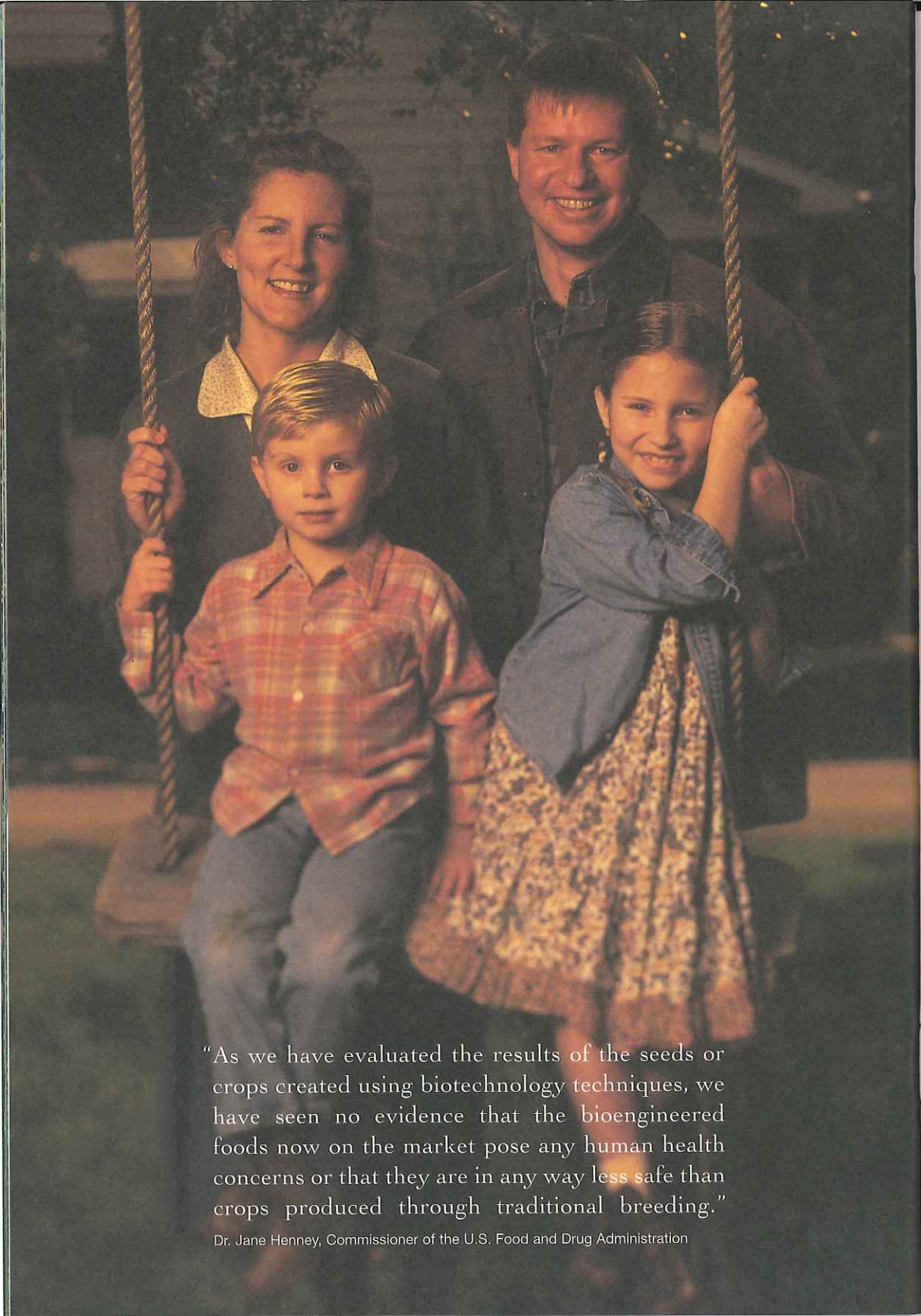
FDA concludes that foods enhanced through biotechnology, as a class, should be regulated in the same fashion as those developed through traditional methods.

1994

The first food product enhanced through biotechnology hits supermarket shelves. The FLAVR SAVR™ tomato is developed to be more flavorful than other tomatoes.

1995

The first soybean developed through biotechnology is introduced.



"As we have evaluated the results of the seeds or crops created using biotechnology techniques, we have seen no evidence that the bioengineered foods now on the market pose any human health concerns or that they are in any way less safe than crops produced through traditional breeding."

Dr. Jane Henney, Commissioner of the U.S. Food and Drug Administration



## Looking for More Information?

Check out these Web sites to learn more about biotechnology and find out what other groups, scientists and government agencies have to say about the benefits of this technology.

**Alliance for Better Foods**  
www.betterfoods.org

**American Crop Protection Association (ACPA)**  
www.acpa.org

**American Dietetic Association (ADA)**  
www.eatright.org/abiotechnology.html

**American Seed Trade Association (ASTA)**  
www.amseed.com

**BIOTECCanada**  
www.biotech.ca

**Biotechnology Industry Organization (BIO)**  
www.bio.org

**Canadian Food Inspection Agency**  
www.cfia-acia.agr.ca

**Council for Agricultural Science and Technology (CAST)**  
www.cast-science.org

**Council for Biotechnology Information**  
www.whybiotech.com

**Crop Protection Institute of Canada**  
www.cropro.org

**C.S. Prakash Director, Center for Plant Biotechnology at Tuskegee University**  
www.agbioworld.com

**Environment Canada**  
www.ec.gc.ca

**U.S. Environmental Protection Agency (EPA)**  
www.epa.gov

**Food Biotechnology Communications Network (Canada)**  
www.foodbiotech.org

**Food Marketing Institute (FMI)**  
www.fmi.org/media/bg/biotech.html

**Health Canada**  
www.hc-sc.gc.ca/english

**Information Systems for Biotechnology (ISB)**  
www.nbiap.vt.edu

**International Food Information Council (IFIC)**  
www.ificinfo.health.org

**International Food Policy Research Institute**  
www.cgiar.org/ifpri

**National Agricultural Biotechnology Center**  
www.cals.cornell.edu/extension/nabc

**United Nations Food and Agriculture Organization (FAO)**  
www.fao.org

**U.S. Department of Agriculture (USDA)**  
**National Agricultural Library**  
www.nal.usda.gov/bic

**U.S. Food and Drug Administration (FDA) Center for Food Safety and Applied Nutrition**  
vm.cfsan.fda.gov/~lrd/biotechm.html

**University of California at Davis**  
ccr.ucdavis.edu/biot/index.html

**University of California at Berkeley**  
plantbio.berkeley.edu/~outreach/OUTREACH.HTM

### 1997

U.S. government fully approves 18 crop applications of biotechnology.

### 1999

Researchers announce the development of a "golden rice" that is rich in beta-carotene, a precursor to vitamin A, to help prevent childhood blindness in developing countries.

### 2000 and beyond

Research continues to identify opportunities to enhance the quality and nutritional profile of foods, further reduce the use of crop protection chemicals and allow farmers to grow more food on the same amount of land.

# COUNCIL FOR BIOTECHNOLOGY INFORMATION



**good ideas are growing**

The Council for Biotechnology Information is an organization founded by leading biotechnology companies in North America. Its purpose is to share information about biotechnology, relying on scientific research, expert opinion and published reports as the basis for its communications.

[www.whybiotech.com](http://www.whybiotech.com)

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