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The Promise of Biotechnology: Providing Better Nutrition

Malnutrition is reaching epidemic levels in the developing world, where millions of people—many of them children—have lost their sight to vitamin A deficiency, hundreds of millions of women of childbearing age don't get enough iron and hundreds of millions of other people whose diets consist mostly of rice might be at risk of iron-deficiency anemia. All told, 800 million people worldwide are chronically undernourished¹, and that number could top 1 billion within 20 years.² Even in the developed world, millions suffer from food allergies, heart disease and other nutrition-related ailments.

But suppose rice consumers could obtain enough vitamin A and iron simply by eating dietary staples that are locally grown? What if children could be vaccinated against deadly diseases just by eating a piece of fruit? Those aren't hypothetical questions. Biotechnology is already producing some of these innovations—and scientists are on the verge of developing countless more.

- *Biotech foods can pack more nutritional content*

Biotechnology is producing foods that contain more proteins, vitamins and minerals and less fatty acids. A worldwide team of scientists is developing a strain of "golden" rice that naturally produces the protein that creates vitamin A and increases iron—potentially preventing blindness, anemia and early death through the foods billions of people already eat every day.³ Biotechnology forms of crops like canola that are now under development have more beta-carotene. Research is under way on a more nutritious strain of cassava, the leading source of calories in Africa.⁴ Fruits and vegetables that may help prevent cancer and heart disease by delivering more of Vitamins C, E and others are also in development.⁵ Other biotech foods, such as a potato that absorbs less oil, may soon prevent heart disease by cutting back on fatty acids.

- *Biotech foods could deliver vaccines orally*

In the United States, routine inoculation against hepatitis B costs about \$200, a prohibitive cost in the developing world. But biotechnology scientists are working on a banana that delivers the vaccine orally. The cost could be less than 10 cents a dose.⁶ No medical personnel would be needed to administer it. And farmers could grow the vaccine right in their own communities, eliminating the transportation and refrigeration problems inherent in depending on faraway labs. Other vaccines delivered through different fruits and vegetables could soon be on the way.

- *Biotech foods could reduce or eliminate allergies*

Biotechnology makes it possible to identify and remove known allergenic agents from foods. The results **could be allergen-free** peanuts and rice.¹⁴

- *Biotechnology is producing better-tasting, longer-lasting food*

Biotechnology is producing foods that **taste better** and **stay fresh longer**. One new type of tomato, for example, ripens slowly, keeping it fresh for longer periods of time. Other innovations **could** include corn and peas that retain their natural sweetness, single-serving melons and a greater availability and variety of foods throughout the year.

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¹ United Nations

² Gordon Conway, president, Rockefeller Foundation, October 19, 1999

³ Conway, *ibid.*

⁴ William H. Danforth, chairman, Donald Danforth Plant Science Center, January 9, 2000;

⁵ John R. Block, former U.S. Secretary of Agriculture, December 22, 1999

⁶ Gregg Easterbrook, November 19, 1999

⁷ Alliance for Better Foods

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Questions & Answers

What is the Council for Biotechnology Information?

The Council for Biotechnology Information is a coalition of the world's leading biotechnology companies created to provide information to the public about the potential benefits of the technology. These include, among others, better quality, better tasting and more nutritious foods; more efficient methods to grow crops with less impact on the environment; and new solutions to help feed a growing population. In addition, biotechnology has great potential for industrial applications, which can result in lower energy utilization, less water required for processing, and better use of renewable resources. Biotechnology creates more options and possible means to develop products to meet the needs of consumers.

Biotechnology has great promise both today and in the future for pharmaceuticals, food and industrial applications. We want to get that message out to as wide an audience as possible.

Specifically, what type of public information effort will the Council undertake?

The Council will give consumers accurate information about biotechnology based on the best available scientific research, published reports, and expert opinion. We will undertake a number of activities as part of the public information program, including paid advertising and the publication of consumer-oriented materials. Our Web site, www.whybiotech.com, provides information on different aspects of biotechnology and allows consumers to learn more about this important technology. We are also supporting a toll-free consumer hotline (1-800-980-8660) that directs callers to a host of resources about biotechnology, including an easy-to-read brochure.

Who makes up the Council?

The Founding Members of the Council are: Aventis CropScience, BASF, Dow Chemical, DuPont, Monsanto, Novartis, Zeneca Ag Products and the Biotechnology Industry Organization (BIO), the leading U.S. trade association for biotechnology companies. Associated with the Council are a range of other organizations and trade and industry groups that support the use of the technology.

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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.

How safe are foods developed through biotechnology?

Crops derived from biotechnology are extensively researched and reviewed. In fact, biotech varieties in North America are **tested more thoroughly than conventional crops before they ever come to market**. In North America, the U.S. Food and Drug Administration, the U.S. Department of Agriculture and the U.S. Environmental Protection Agency, as well as many of the individual state governments, the Canadian Food Inspection Agency and Health Canada, work to ensure the safety of biotechnology. Standards used to evaluate food safety have been developed and agreed upon by international scientific authorities, such as the World Health Organization and the United Nations Food and Agricultural Organization. In the United States, the use of food biotechnology has been supported by major health organizations, including the American Medical Association (AMA) and the American Dietetic Association (ADA).

How can biotech crops address world hunger issues?

The issue of world hunger is complex and biotechnology alone cannot solve this challenge. However, it can help. According to the United Nations Population Fund, the world's population will likely increase to approximately 9 billion by 2050. **Biotechnology makes it possible to grow more and healthier foods in the tough conditions that farmers in the developing world often face**—like drought, changing weather patterns or poor soil. Biotechnology can also reduce crop losses to pests, disease and spoilage by producing crops that resist insects and viruses. **John Block**, former U.S. Secretary of Agriculture, **says** that biotechnology could boost food productivity in the developing world by as much as 25 percent. Biotech foods could also help to combat malnutrition in developing nations by delivering higher doses of vitamins, proteins and other nutrients in crops.

How can biotechnology help the environment?

Discoveries in biotechnology allow some crops to have their own protection against insects and disease and, therefore, can be grown using fewer 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, a practice known as Integrated Pest Management (IPM). Biotechnology can

also 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 run off into streams and rivers.

Are biotech foods really more nutritious than conventional foods?

Now and in the near future biotechnology products provide potential food quality improvements. Some biotech foods may help to prevent heart disease and cancer by delivering more of vitamins C and E. Research is under way on "golden rice," which would combat vitamin A deficiency in developing nations by delivering more beta-carotene. Other biotech foods, like a potato that absorbs less oil, may help to prevent heart disease by cutting back on fatty acids. Biotechnology could improve nutrition in other ways, such as producing allergy-free peanuts and rice. Researchers are even working on a banana that could deliver vaccines against hepatitis B and other deadly diseases.

What are the most common biotech crops? What crops are in development?

According to USDA estimates, about 55 percent of soybeans, 60 percent of cotton and 36 percent of corn grown in the United States in 1999 were derived through biotechnology. More than 60 million acres of biotech crops have been planted in the United States, and researchers continue to work on a variety of new biotech crops. For example, new strains of rice and other subsistence crops would help combat vitamin A deficiency—a leading cause of blindness in the developing world—by delivering higher doses of beta-carotene.

What other uses of biotechnology are there besides food?

There are many potential benefits of biotechnology. One major area is **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.

Another potential area of benefit is in industrial applications. In the future, some applications of biotechnology will be used to make materials such as fibers for clothes from "renewable" resources like corn. Some applications of industrial biotechnology may help reduce our dependence on oil and natural gas and could reduce water and energy use by as much as 50 percent.

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The Promise of Biotechnology: Helping to Protect the Environment

High-tech progress in a centuries-old practice—improving the genetic characteristics of crops—could help solve a 21st Century problem: How to grow enough food for a booming world population without placing too much strain on the environment. Modern biotechnology is producing crops that conserve natural resources, in some cases reduce the use of crop protection chemicals in agriculture, provide farmers another choice in insect and disease control, and offer a wide range of other environmental benefits.

- *Biotech crops can conserve soil and water*

Every year, the earth loses enough topsoil to cover the state of Missouri, and it takes literally centuries to replace.¹ Traditional agricultural practices can cause the erosion of large quantities of topsoil as well as use large amounts of water and other resources. But some biotech crops are being researched to absorb nutrients from the soil more efficiently and to grow in poor conditions, which would reduce the need for tillage and irrigation. Because many biotech crops produce more food per acre, they conserve land itself. By one estimate, in fact, biotechnology could boost food productivity in the developing world by as much as 25 percent.² Biotechnology could play a major role in improving the productivity of areas that are difficult to farm.

- *Biotechnology can help preserve natural resources*

Farmers in the developing world are clear-cutting temperate and tropical forests for agriculture at a disturbing pace, either because the land offers better growing conditions than their current farmland or because they simply need the extra acreage to feed their ever growing populations. The developed world faces a similar challenge: how to get more food from the same amount of land. Some biotech crops make it possible to grow more food on already cultivated land. Others will soon be able to grow in tough weather and soil conditions such as drought or high salinity.³ As a result, biotechnology could help keep fragile soils out of food production. And as more food is harvested on the same amount of land, the use of other resources—such as fossil fuels like oil and natural gas, which are required in order to run agricultural machinery—may not need to increase to support higher crop yields.

- *Biotech crops can reduce the use of crop protection chemicals in agriculture*

Some crops developed using biotechnology have built-in protection from disease and insects, giving the farmer another tool for keeping crops healthy and productive. Modern farmers use Integrated Pest Management (IPM) to balance profitable crop production and environmental stewardship. They use a combination of tools to

protect their crops against pest insects, such as monitoring for early warning of infestations, understanding the insects' life cycles, encouraging beneficial insects, planting resistant crops, and applying crop protection chemicals when necessary. As a result, biotech crops can reduce the use of agricultural chemicals such as insecticides and fungicides. Scientists have developed strains of corn and cotton that produce their own protection against specifically targeted pests. According to the National Agricultural Statistics Service, two million fewer pounds of insecticide were used in 1998 to control bollworm and budworm than were used in 1995, before Bt insect protected cotton was introduced.

In addition, research is ongoing to develop biotech crops that absorb more nutrients so that they may require less fertilizer.

¹ William H. Dandorf, chairman, Donald Dandorf Plant Science Center, January 9, 2000

² John R. Block, former U.S. Secretary of Agriculture, December 22, 1999

³ Gordon Conway, president of the Rockefeller Foundation, October 19, 1999

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The Promise of Biotechnology: Regulation, Safety and Government Oversight

Like any emerging technology, biotechnology has been the subject of questions, especially about its safety. Biotech foods are extensively researched and reviewed. In fact, biotech varieties are tested more thoroughly than conventional crops before they ever come to market. In the United States, three government agencies—as well as many individual state governments—work together to ensure that crops produced through biotechnology are safe to eat and protective of the environment. In 1992, federal policy determined that foods produced through biotechnology must meet the same standards of dietary and environmental safety as other products.¹ Here's how the safety of biotechnology foods is ensured in the United States today:

- *The FDA and the Food, Drug and Cosmetic Act*

Biotech foods, like others, are subject to the Food, Drug and Cosmetic Act, which gives the Food and Drug Administration sweeping authority to regulate their safety.⁸ The Act permits the FDA to remove any harmful product from store shelves at any time and to criminally prosecute its manufacturer. The FDA looks at a wide range of factors before approving foods, including their safety, nutrition and potential for allergies and toxins. Manufacturers bear a legal obligation to ensure the safety of food, and they test products extensively to meet it. One strain of biotechnology soybean was subjected to 1,800 analyses.⁹

As FDA Commissioner Jane Henney described the process, "With the tools developed from biotechnology, a gene can be inserted into a plant to give it a specific new characteristic instead of mixing all of the genes from two plants and seeing what comes out. Once in the plant, the new gene does what all genes do: It directs the production of a specific protein that makes the plant uniquely different."¹⁰ David Aaron of the U.S. Department of Commerce addressed the safety issue simply in testimony before the Senate Finance Committee: "[T]hirteen years of U.S. experience with biotech products have produced no evidence of food safety risks; not one rash, not one cough, not one sore throat; not one headache."¹¹

- *Current policy on labels*

Like other products, current law requires biotech foods to be labeled if their composition or nutritional content is significantly different from their conventional counterparts or if they pose any health risk. The FDA requires labels if biotech foods contain genetic material from known allergens unless data show there is no allergy risk.¹² Otherwise, regulators have decided that biotech foods are as safe as food produced through conventional methods.

- *Government safeguards work*

This regulatory structure, which includes rigorous testing by manufacturers, builds safeguards to protect against foods that might pose safety risks making it to market. One company, for example, developed a soybean that used a gene from the Brazil nut to enhance its value for livestock feed. Although it was already in the development phase, the company stopped development after discovering that a small percentage of the public was allergic to the protein derived from the nut—even though it was unlikely the soybean would enter the human food supply.^{vii}

- *Environmental regulation*

Also like other crops or agricultural methods, biotech crops are strictly regulated by the Environmental Protection Agency and the U.S. Department of Agriculture. Biotech foods and products are subjected to a wide range of environmental laws, as well as a broad array of state and local standards. The EPA regulates pest- and insect-resistant biotech crops. USDA's Animal and Plant Health Inspection Service (APHIS) oversees field and agriculture environmental testing of biotech crops.

Canadian Standards

The Canadian government strictly regulates biotechnology foods to ensure their dietary and environmental safety. Biotechnology seeds and foods, like other products, are carefully regulated by the Canadian Food Inspection Agency, Health Canada and Environment Canada. **International organizations like the United Nations, the World Health Organization and the World Trade Organization provide additional protection.** Current law requires biotech foods to be labeled if their composition or nutritional content is significantly different from their conventional counterparts or if they pose any health risk. In addition, the Canadian federal government is also working with food producers and others to craft voluntary labeling standards for biotechnology foods.^{viii} ?

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ⁱ Statement of Policy: Foods Produced From New Plant Varieties, 57 Fed.Reg. 22,984

ⁱⁱ FDA Commissioner Jane Henney, "Are Bioengineered Foods Safe?", FDA Consumer Magazine, January-February 2000

ⁱⁱⁱ University of Edinburgh biologist Anthony Trewavas, December 20, 1999

^{iv} Henney, *ibid.*

^v Testimony to the U.S. Senate Committee on International Trade, October 7, 1999

^{vi} Henney, *ibid.*

^{vii} *Los Angeles Times*, October 5, 1999

^{viii} **BIOTECanada**

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The Promise of Biotechnology: Food for a Growing World Population

In the fall of 1999, the world population reached 6 billion. It could top 9 billion by 2050, with most of the growth occurring in poor areas of the developing world.¹ The world's supply of usable farmland is shrinking, while the growing population will require more land for housing and other infrastructure. Biotechnology **may be** part of the solution to ensuring food security while sustaining the world's resources, which is a very necessary but delicate balancing act.

According to the United Nations, 800 million people worldwide are already chronically malnourished. The U.N. Food and Agriculture Organization estimates that two out of five children in the developing world are stunted, one in three is underweight and one in ten is "wasted" due to undernourishment. The problem will worsen as the population grows: by 2020, the number of undernourished people may have topped 1 billion.² Biotechnology alone won't solve the problems of hunger and malnutrition, but it can play an important role in alleviating them by making it possible to grow more food with added nutrition, on less land and under tough conditions. That's why people like former President Jimmy Carter call biotechnology a key to feeding a growing population in the 21st Century.³

- *Biotech foods can make it possible to obtain more food from the same land, especially under tough growing conditions*

Biotechnology **could** increase crop productivity in the developing world by as much as 25 percent.⁴ Biotechnology can also help to prevent loss of foods and grains post-harvest, thereby increasing the amount of the food produced. And many biotech crops **may be able** to grow under the tough growing conditions—such as drought, changing weather and nutrient-depleted soil—that farmers in the developing world routinely face.⁵

- *Biotech foods can reduce crop losses to pests and disease*

The developing world loses tragic amounts of crops to pests and disease. The European corn borer, for example, destroys approximately 7 percent, or 40 million tons, of the world's corn crop every year – equivalent to the annual food supply, in calories, for 60 million people.⁶ In 1998, the people of Africa lost 60 percent of the cassava crop—one of their most important sources of calories—to mosaic virus.⁷ Biotechnology is helping to solve that problem by producing crops that resist pests and disease. Biotech corn, which is already widely used in the United States, produces its own protection against the corn borer. Research is under way on virus-

resistant sweet potatoes and other crops. Other biotech foods could reduce losses to spoilage, especially in developing countries that lack refrigeration.

- *Biotech crops can be more nutritious*

As many as 100 million children worldwide suffer from **vitamin A** deficiency, the developing world's leading cause of blindness. Some 400 million women of childbearing age are **iron-deficient**, placing their babies at risk of physical and mental retardation, premature births and natal mortality.¹⁰¹ Biotechnology **could** help prevent blindness, malnutrition and other maladies by producing more healthful, nutritious crops. A strain of "golden rice" that packs more iron and beta-carotene, a precursor of vitamin A, **could** be on the world market within a few years. Scientists have discovered a way to boost beta-carotene levels in canola¹⁰². And cutting-edge research could soon produce a banana that delivers the vaccine for hepatitis B, making it possible to inoculate against deadly diseases with a locally grown crop that is easy to handle, distribute and administer.

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¹ United Nations Population Fund

² Gordon Conway, president of the Rockefeller Foundation, October 19, 1999

³ Carter, August 26, 1998

⁴ **John R. Block**, former U.S. Secretary of Agriculture, December 22, 1999

⁵ Conway, *ibid.*

⁶ Gianessi and Carpenter (1999), National Center for Food and Agricultural Policy

⁷ William H. Danforth, chairman, Donald Danforth Plant Science Center, January 9, 2000

⁸ Conway, *ibid.*

⁹ Shewmaker, et al. (1999) *The Plant Journal* 20:401-412

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The Promise of Biotechnology: Overview
Council for Biotechnology Information

The Council for Biotechnology Information is an organization founded by leading biotechnology companies in North America to create a public dialogue and share information about biotechnology that is based on scientific research, expert opinion and published reports.

Biotechnology is the latest in a series of tools with wide-ranging uses that can improve our quality of life—from pharmaceuticals to food to industrial materials. Used in combination with other methods, biotechnology has enormous potential for people around the world.

For example, agricultural productivity must continue to improve to meet the growing demand for added quantity, quality and variety in the food supply for an increasing world population. One of the great challenges of the 21st Century will be how to provide people around the world with sufficient quantities of nutritious food, while limiting the environmental impact caused by added agricultural production. Biotechnology will not be the only solution to this challenge, but it can be an important part of the solution.

The mission of the Council for Biotechnology Information is to share accurate, scientific information on the benefits of biotechnology to interested individuals and organizations. Participants in the Council recognize that scientific understanding alone is not enough. We respect the fact that biotechnology also raises philosophical questions and concerns. These, too, must be addressed. The Council seeks to listen to and address concerns and respect differences of opinion. As we work to enhance the public's understanding of biotechnology, we will continue our commitment to responsible behavior and scientific research.

The Council for Biotechnology Information will work with existing organizations to share information about biotechnology. In addition, it will embrace outreach programs to establish a dialogue with the food industry, health professionals, academia, scientists and other interested parties. The Council will provide public information directly through a Web site (www.whybiotech.com), brochures and printed materials, advertising and a toll-free number (1-800-980-8660). Individuals and organizations in agreement with the core beliefs of the Council and supportive of its mission are invited to join.

The founders of the Council are Aventis CropScience, BASF, Biotechnology Industry Organization, Dow Chemical, DuPont, Monsanto, Novartis and Zeneca Ag Products.

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The Council holds several core beliefs about biotechnology:

- **The Council believes in the safety of biotechnology.** Biotechnology is extensively researched and reviewed, and has **rigorous government oversight.** Biotechnology products are tested more thoroughly than conventional crops before they ever come to market.
- The Council believes that all foods, including those derived through genetic modification, should continue to be subject to a rigorous government regulatory process that evaluates the safety of the products to the consumer and the environment. This process should be based on responsible science that meets state-of-the-art scientific standards.
- The Council believes that biotechnology **can deliver significant benefits—for consumers who seek better quality, better tasting and more nutritious foods; for farmers who want more efficient methods to grow crops with less impact on the environment; and for developing countries seeking solutions to help feed a growing population.**

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