
Agriculture
Canada
BIOTECHNOLOGY
IN AGRICULTURE
SCIENCE
FOR BETTER LIVING
Canada

What is Biotechnology?

Do you eat bread, cheese, or use antibiotics?

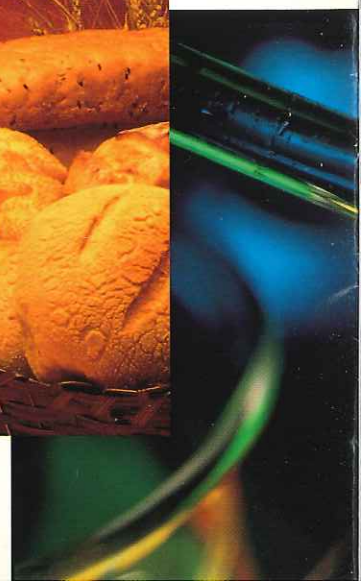
Then you have been enjoying the fruits of biotechnology.

Biotechnology is the applied use of living organisms, or their parts, to produce new products.

Many traditional food-making processes depend on living organisms. Yeast, a fungus, is used to make bread rise. Bacteria is used to "age" cheese and make sour cream. Some medicines, such as antibiotics, are manufactured from substances produced from other organisms, such as bacteria and fungi. In fact, the scientist who discovered penicillin started out with a piece of mouldy bread. Today, scientists are refining these biotechnology methods so that the results are controlled and specific.

Do you know what long-stemmed roses and low-fat pork have in common?

Both are the result of very old agricultural practices that improve the characteristics of plants or animals through selective breeding. For hundreds of years, farmers have created new and better products for consumers by breeding only the plants or animals with the most desirable characteristics.



The new wave of biotechnology

Since the 1970s, researchers have learned how to take these traditional techniques one step further. They have shortened the cross-breeding process and increased its precision by working directly with the genes of organisms. Genes are the hereditary units that form the "blueprint" of an organism. Scientists can remove or change specific genes that determine particular characteristics, and transplant those genes into another organism's genetic makeup.

Working with tomato plants, for instance, scientists have modified a gene involved in the ripening process in order to develop better quality tomatoes that take longer to ripen, and are slower to spoil. When this gene is transplanted into other tomato plants, the resulting new plants can then become part of a breeding program. These plants may eventually become a new commercial variety.

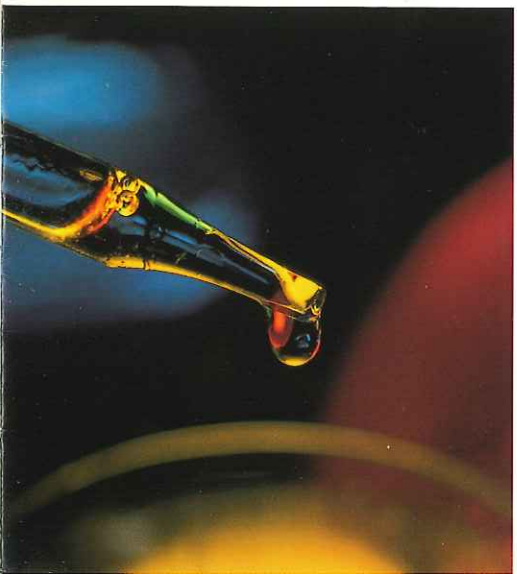
The transplanting of genes, more commonly known as "genetic engineering" or "recombinant DNA technology", is the newest technique of biotechnology. Scientists are applying it to crops and animals to improve characteristics such as resistance to various diseases. They may also use it to help farm animals become better producers of milk, meat and eggs.

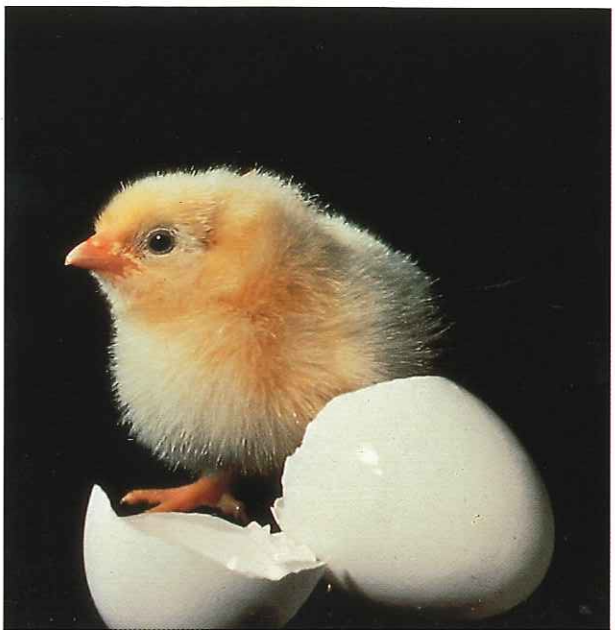
Combining genetic engineering with conventional breeding methods is a quicker, more accurate way of producing new foods, and new plant and animal varieties. For example, a crop breeder may now be able to introduce a new characteristic into a crop variety in two or three years, rather than the 12 to 15 years it could take using conventional methods. It is now possible to breed crops with new characteristics, like resistance to insects, frost or disease, using genetic engineering. And some of these new crops will reduce the need for chemicals in agriculture.

How will biotechnology affect you?

Biotechnology could become as much a part of our everyday lives as the computer has. It will change the way some common goods and materials are produced. It will also generate many new products, from foods to fertilizers to fuel. For the consumer, this means better quality and greater selection.

Biotechnology will also have major payoffs for Canada's economy. It will create opportunities for farmers, food processors and distributors to sell new or improved goods in Canada and around the world. In fact, some biotechnology techniques themselves – such as rapid tests for diagnosing certain animal diseases – are being developed as marketable products.





Here are a few examples of the possibilities:

improved crops

Working with plant genes, scientists will continue to develop new kinds of disease- and pest-resistant crop varieties. They will also develop new crop varieties able to withstand cold temperatures, drought, and other environmental stresses.

enhanced food products

Fast-rising dough, new processes to clarify fruit juices and wine, low-calorie sweeteners, cereals with higher nutritional quality, leaner meat – these are among the potential products of biotechnology. In addition, new processes could add nutritional value to many human foods and animal feed.

better, healthier animals

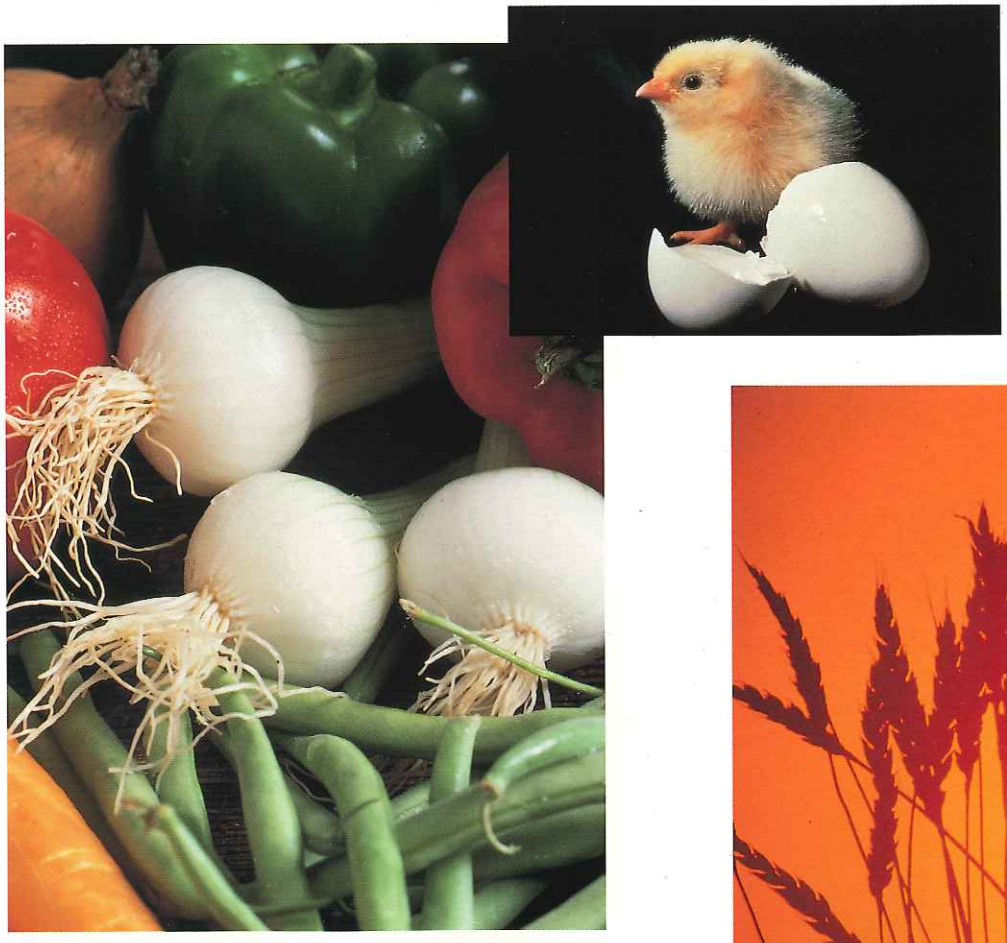
By modifying the genes of farm animals, scientists will help them to bear healthy offspring with desirable new or added characteristics, like the ability to resist various infections and diseases. New vaccines will be used to protect animals from diseases like foot-and-mouth disease and rabies.

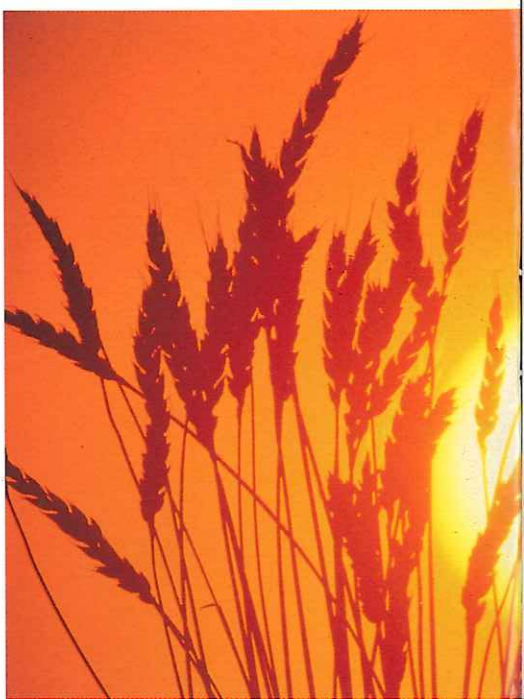
chemical substitutes

In addition to traditional chemicals, farmers will be able to choose from a wider range of "environmentally compatible" biological pest control products and fertilizers. Specially bred plants will have more effective defences against pests. Animal feeds produced by biotechnology could also mean more nutritious feed alternatives.

new diagnostic kits

Diagnostic kits, using cell products such as enzymes and antibodies, will allow quicker and more exact identification of disease organisms in crops and animals.





Questions about the new technology

Genetic engineering, like any new technology, raises some important questions; questions on the introduction of a modified organism into nature, for example.

Before anyone releases these new products into the environment, it is important for research to be carried out to demonstrate that:

- *the organism does not turn into a future pest or weed;*
- *the organism does not exhibit unexpected characteristics outside the laboratory which could affect other useful plants or organisms; and*
- *unintended characteristics do not spread to related species.*

Biotechnology is a complex science. Government, industry and the public will have to work as partners to develop the best and safest ways of benefitting from biotechnology.

What is Agriculture Canada doing?

Agriculture Canada is the federal government department responsible for the safety and use of agricultural products. The Department also conducts research in key areas of biotechnology to develop new processes, improved products, and to ensure product safety.

Agriculture Canada evaluates agricultural products, including those derived through biotechnology, under various acts and regulations. These products include foods, animal vaccines and feeds, biofertilizers, biopesticides, seeds, plants or plant products, and transgenic animals. In the development of its regulations and guidelines, Agriculture Canada confers with many Canadians with differing viewpoints including scientists, representatives of industry, public interest groups, and expert advisors from other government departments (Health and Welfare Canada, Environment Canada, Consumer and Corporate Affairs, Forestry Canada, and Fisheries and Oceans).

By law,* researchers and manufacturers must meet specific requirements before testing potential agricultural products outside the laboratory, and before selling or importing these products. Agriculture Canada evaluates these products to weigh possible risks to the environment and human health before allowing field trials or the commercial use of products.

And as new technologies emerge – whether they apply to biotechnology research or food processing – the federal government responds to keep pace with new developments and to protect the Canadian public.

Do you want to know more?

For more information on biotechnology, or research and regulation in Agriculture Canada, please write to:

Biotechnology Coordination Office
Food Production and Inspection Branch
Agriculture Canada
Ottawa, Ontario
K1A 0C6

* The legal responsibilities of researchers and manufacturers for agricultural products, including those produced by biotechnology, are described in: the *Health of Animals Act and Regulations*; the *Canada Agricultural Products Act and Regulations*; the *Feeds Act and Regulations*; the *Fertilizers Act and Regulations*; the *Meat Inspection Act and Regulations*; the *Pest Control Products Act and Regulations*; the *Plant Protection Act and Regulations*, and the *Seeds Act and Regulations*.

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