# Truth about genetically modified foods

By Dr Lawrence D. Abbey & Augustine Andoh

**THIS year, 2006, we saw many articles in the local newspapers, the *Daily Graphic* and the *Chronicle* which cautioned against the introduction of genetically modified (GM) food crops in the country.**

In Africa, some governments have categorically come out with statements that have banned genetically modified products.

The field of nutrition, food science and technology has seen many interesting developments in the last 100 years. By the end of the 18th century, science was beginning to uncover the essential elements in food.

Within the 100 years, it has been known that foods contain fats, water, carbohydrate, protein and minerals. In what is termed the first golden age of nutrition (1910-1950), a sixth class of food elements, vitamins were discovered.

The 20th century saw scientists isolate vitamin after vitamin from foods. By 1950, all the 13 minerals that we know today had been discovered.

Today, it has been realised that there may be much more than vitamins and minerals in food. Phytochemistry, or the chemistry of plants, one of the early subdivisions of organic chemistry, has been of great importance in plant systematics studies.

With the development of new phytochemical methods, another class of substances in food, called phytochemicals, has been recognised for their medicinal importance. Phytochemicals are substances, extracts or pigments found in plants, fruits and vegetables that have beneficial effects on consumers.

Gregor Mendel, the great Mathematician and Biologist, may have been the first to formally unravel the origins and transmission of specific traits in plants and animals, however, the practice of selective breeding to enhance desirable traits in both "domesticated" crops and animals has been pursued by human populations since at least the beginning of recorded time.

In recent years, recombinant techniques have joined the arsenal of tools applied to the task. Today, new biotechnology and recombinant DNA technology have led to new techniques for introducing foreign or modified DNA sequences into plant genomes and more efficient ways to regenerate whole plants from recombinant clones of cells cultured in the laboratory (GM crops). In addition, plant strains are being engineered for resistance to pest assaults from insects, fungus, virus and bacterial.

These GM foods, ever since, had created confusion and political furore in many parts of the world. The main proponents of GM foods are Americans, and the main skeptics are Europeans and most of the developing world.

The precautionary approach to the adoption of production of the GM crops is good, because its main concerns are for good, safe and nutritious foods for the people. Let us look at some of the counter arguments.

On one side of the controversy, the protagonists argued that GM foods could obviously be regarded as one of the biggest advances ever chalked up in agriculture, while those in opposition believed that GM foods could trigger a wide variety of serious environmental and health problems with dire consequences to life on the Planet Earth.

The ever-increasing scientific evidence available supporting either view is far from complete and might not become so without field trials extending over several crop seasons.

With huge sums invested by giant agribusinesses in the research and development of such foods, the stakes are obviously high. Public opinion and perception remained deeply divided, sometimes acrimoniously so.

The result continues to be a junk mix of fact and fiction, opinion and prejudice, and governments pitted against one another in one of the most-challenging policy debates within the decade.

Professor Daryl Lund, University of Wisconsin-Madison, United States of America, gave much food for thought at seminars, at the Food Research Institute of Council for Scientific and Industrial Research (CSIR) and the Nutrition and Food Science Department of the University of Ghana this year.

He believes that biotechnology has a great future. But for this future and its benefits to be realised, it ought to be explained properly.

The United States has about 42.8 million hectares of land in use for GM crops use being used for canola, maize, soybeans and cotton. Argentina and Canada have 4.4 million hectartes under cultivation being used for maize, soybean, cotton and canola. Brazil has about three million hectares under use for soybeans.

In the European Economic Community, they have decided to use the precautionary principle to regulate biotechnology. In the last 18 months, they approved the use of some genetically modified maize products in the European Union (EU).

In Africa, however, the only place which is using many GM organisms is in South Africa where they have about 400,000 hectares using it on cotton, maize and soybeans. The rest of Africa basically has either decided not to use GM plant materials or is still in the process of deciding how to use it.

There has been rapid advancement in deciphering the genome of the various organisms. The main advances in biotechnology are in genomics and subsequently proteonomics. These are followed by metabolites or the products that are produced by the protein enzymes.

The human body with about 30,000 genes is as complicated as the mouse. Rice has even more genes (50,000 genes) than humans do. It is the understanding of the genome that allows ultimately us to get at the quality traits of these various materials. This then offers us an insight into the nature of the enzymes that are produced by those genes that ultimately allow us to understand better whatever reactions and products these proteins undergo.

The advantage of developing countries is that we can benefit from the advances of new research and development without being in the forefront. All stakeholders must understand the issues even if for purely academic purposes.

Scientific developments and advanced technologies have brought about new jargons which make it difficult for stakeholders, such as government, politicians, and even consumers to understand.

The jargon of the green revolution did not create many problems. It rightly envisaged that if a country put together a good selection of seeds, irrigation infrastructure, research-farmer extension and other inputs, a good agricultural output could be achieved.

We have old biotechnology which involved fermentation as in bread baking or the making of beer. We have new biotechnology which involves horizontal genetic manipulation across crop or animal species to make better breeds. Then we have genetic engineering which may involve the fusion of animal or plant genes. So biotechnology is taken to be the same as genetic engineering.

There is a list of problems that could be addressed through the use of genetic engineering or 'true biotechnology" as Professor Lund might put it.

The first problem biotechnology can help solve is world hunger and nutrition. We need not look much further than the yield increases between 1962 and 2002.

Food and Agriculture Organisation (FAO) statistics show that between 1962 and 2002, there was a 200 per cent increase in the amount of wheat that was produced through genetic manipulation.

It is also worth mentioning that the green revolution through natural selection, also recorded substantial increases in yield without inserting genes into the crop. As the statistics show, cassava yields increased by 43 per cent during that 40 year period, from 7.5 t/ha to 10.7 t/ha. Says Professor Lund, "true biotechnology is going to have an opportunity to increase the yield of those crops even more". Scientists could show that GM crops resist pests, grow in salty soils and produce food that is both more nutritious and more stable in storage.

In future, biotechnology will be used in particular to manufacture various ingredients such as food flavours and stabilising agents that may be used in food.

With regard to plant derived vaccines (biopharming), there is a great deal of interest in these. Whether these are going to be generated in the plant or extracted from the plant, would be a matter of time. Lund's opinion is that biotechnology through biopharming will be very actively promoted and used.

Some of the most exciting biopharming techniques he mentioned were on the treatment of chronic disease, the development of antibiotics, vaccines and antigens into a number of products.

For instance, it has been discovered that there are various types of materials that could be built into cowpea with the potential to inhibit the HIV disease or at least delay its onset.

How do we utilise or regulate this knowledge in order to attack chronic disease using biotechnology? This is a question for scientists and governments. Scientists need to develop rational ways of regulating this. But it is for the government to adopt them.

The world is on the threshold of sensory science in the quest to understand the sensory attributes of both flavour and taste. It is also hoped that with biotechnology, it should be possible to design products that will deliver whatever sensory attributes the consumer wants.

In the areas of food safety, a number of botanical products, such as garlic ginger, cloves, rosemary, etc have been shown to have anti-microbial and/or antioxidant activity. More research may need to be done to identify and characterise the major constituents in order to be able to sufficiently isolate these constituents.

Biotechnology may also assist in developing food processing aids such as enzymes in great quantities, much greater than it is possible now, and use that in the processing of food products.

What about the future of food science research in the 21st century?

Everybody has to eat, everybody has to spend money on food, so food science and technology research and programmes are an economic development activity. They provide the source of income and employment in many economies.

In Ghana, about 60 per cent is engaged in food processing. Obviously having an indigenous food processing centres means that we are relying less on imports. Clearly, the trend is to increase the processing that is done outside the home.

On the global scene, nothing is transforming the food industry as the relationship between diet, health and food connections, whether with regard to chronic disease or acute disease. And so, understanding the relationship between what we eat and those diseases is increasing at a very rapid rate.

Another area which is increasingly gaining research attention is a molecular understanding of the processes which occur both under physiological and during the processing of food.

Obviously, understanding the composition of food, the whole "neutraceuticals phenomena" (health promoting materials) that have biological and physiological is essential for the future.

Nanotechnology is the ability to manipulate single atoms. This will revolutionarise our abilities to detect, make new structures, understand what is happening in the chemical world, and create atomic structures.

Biotechnology is also going into the area of packaging by creating unique packaging systems. Innovative packaging technology using substances with antimicrobial, activity, which when released into the package, could prevent microbial growth as well as smart packaging with developing decay sensor and/or temperature indicator are being studied.

Real-time analysis (rapid analysis) with regard to food safety is a useful tool. This is true for the control of a variety of parameters, including compositional factors.

Food preservation still holds relevance in the 21st century. Clearly, the trend is to increase the processing that is done outside the home and introduce closer and closer "ready-to-eat" foods. That is happening in every economy. It has happened already in many of the developed economies. In the developing economies, we are moving towards highly processed foods on an industrial scale for preservation and food security.

We want to decrease hazardous materials in food, including microorganisms, while at the same time maintain the nutritional value of food.

There are, however, a quite a number of new processes of which some have already been developed in the food industry. One of such processes is high pressure technology which is used in many places, including Europe, Japan, and U.S, etc.

Irradiation is still gradually being transformed and applied in food preservation. However, 50 years after the application of irradiation to foods, it is yet to be seen as having been acceptable to society in general.

The other processes like ultra sound, ohmic heating are in use in such countries as the United States and Japan. Sensory analysis and consumer protection have also taken on in an increased focus.

Scientists and communicators need to break down some of the jargon of some of the new technologies (and processes) so that policy makers, the consuming and lay publics can make clear choices and wise decisions.

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