

Genetically modified foods

Genetic modification is now possible using biotechnology. The genetic material may be altered with methods that do not occur naturally - this is known as 'genetic engineering'. Selected individual genes are transferred from one organism to another. Traditional breeding can achieve similar effects, but over a much longer time span. However, traditional breeding cannot achieve the same effects using a transferred gene from a non-related species - this is possible with GM foods.

Genetic engineering broadens the scope to modify plants

Genetic modification of food is not new. For centuries, food crops and animals have been altered through selective breeding. While genes can be transferred during selective breeding, the scope for exchanging genetic material is much wider using genetic engineering. In theory, genetic engineering allows genetic material to be transferred between any organism, including between plants and animals. For example, the gene from a fish that lives in very cold seas has been inserted into a strawberry, allowing the fruit to be frost-tolerant. This has not as yet been done for currently available commercial food crops.

Foods that have been modified

Some foods have been modified to make them resistant to insects and viruses and more able to tolerate herbicides. Crops that have been modified for these purposes, with approval from the relevant authorities, in a number of countries, include:

- Maize
- Soybean
- Oilseed rape (canola)
- Chicory
- Squash
- Potato.

Modified genes may be present in whole foods, such as soybeans, maize and tomatoes. These GM whole foods are not presently available in Australia. Genetically modified food ingredients **are**, however, present in some Australian foods. For example, soy flour in bread may have come from imported GM soybeans.

Modified genes may have been used in an early stage of the food chain, but may or may not be present in the end product. Gene products - for example, phytochemicals (plant chemicals that contain compounds which may prevent disease) - may, however, remain in the food chain. This could be an advantage or a disadvantage.

Organic foods are not genetically modified

Foods certified as organic or biodynamic should not contain any GM ingredients, according to industry guidelines.

Nutritional enhancement

Genetic engineering can also be used to increase the amount of particular nutrients (like vitamins) in food crops. Research into this technique, sometimes called 'nutritional enhancement', is now at an advanced stage. Researchers are especially looking at major health problems like iron and vitamin A deficiency. The removal of the protein in peanuts that causes allergies in some people is also being researched.

Benefits of GM foods

There is a need to produce inexpensive, safe and nutritious foods to help feed the world's growing population. Genetic modification may provide:

- Better quality food
- Higher nutritional yields
- Inexpensive and nutritious food, like carrots with more antioxidants

- Foods with a greater shelf life, like tomatoes that taste better and last longer
- Food with medicinal benefits, such as edible vaccines - for example, bananas with bacterial or rotavirus antigens
- Crops and produce that require less chemical application, such as herbicide resistant canola.

Advocates argue that GM foods are potentially better for the environment. By using genetically engineered crops that are resistant to attack by pests or disease, farmers and primary producers do not have to apply large amounts of pesticides and chemicals to the surrounding environment. Developing crops that are resistant to particular herbicides and pesticides may reduce the amount of pesticides used in food production and the residual pesticide levels in the environment.

The risks of genetically modified crops

Food regulatory authorities require that GM foods receive individual pre-market safety assessments. Also, the principle of 'substantial equivalence' is used. This means that an existing food is compared with its genetically modified counterpart to find any differences between the existing food and the new product. The assessment investigates:

- Toxicity (using similar methods to those used for conventional foods)
- Tendency to provoke any allergic reaction
- Stability of the inserted gene
- Whether there is any nutritional deficit or change in the GM food
- Any other unintended effects of the gene insertion.

A GM food will only be approved for sale if it is safe and is as nutritious as its conventional counterparts. The safety of GM foods is still being debated, as it is impossible to predict all of the potential effects on human health and the environment. Some public health experts, however, advocate caution and believe that 'we are only at the "scientific starting line", we simply don't know whether GM foods are safe'. Stephen Leeder, 'Genetically modified foods - food for thought', MJA www.mja.com.au

Some concerns that have been raised by scientists, community groups and members of the public include:

- **New allergens could be inadvertently created** - known allergens could be transferred from traditional foods into GM foods. For instance, during laboratory testing, a gene from the Brazil nut was introduced into soybeans. It was found that people with allergies to Brazil nuts could also be allergic to soybeans that had been genetically modified in this way. No allergic effects have been found with currently approved GM foods.
- **Antibiotic resistance may develop** - bioengineers sometimes insert a 'marker' gene to help them identify whether a new gene has been successfully introduced to the host DNA. One such marker gene is for resistance to particular antibiotics. If genes coded for such resistance enter the food chain and are taken up by human gut microflora, the effectiveness of antibiotics could be reduced and human infectious disease risk increased. Research has shown that the risk is very low; however, there is general agreement that use of these markers should be phased out. Stephen Leeder, 'Genetically modified foods - food for thought', MJA www.mja.com.au, John Huppatz and Paula A Fitzgerald, MJA 2000
- **Cross-breeding** - other risks include the potential for cross-breeding between GM crops and surrounding vegetation, including weeds. This could result in weeds that are resistant to herbicides and would thus require a greater use of herbicides, which could lead to soil and water contamination. The environmental safety aspects of GM crops vary considerably according to local conditions.
- **Pesticide resistant insects** - the genetic modification of some crops to permanently produce the natural biopesticide *Bacillus thuringiensis* (Bt) toxin could encourage the evolution of Bt-resistant insects, rendering the spray ineffective. Wherever pesticides are used, insect resistance can occur and good agricultural practice includes strategies to minimise this.
- **Biodiversity** - growing GM crops on a large scale may also have implications for biodiversity, the balance of wildlife and the environment. This is why environmental agencies closely monitor their use.
- **Cross-contamination** - plants bioengineered to produce pharmaceuticals (medicines etc) may contaminate food crops. Provisions have been introduced in the USA requiring substantial buffer zones, use of separate equipment and a rule that land used for such crops lie fallow for the next year.

Ethical concerns

Concerns about genetic modification include:

- The possible monopolisation of the world food market by large multinational companies that control the distribution of GM seeds.
- Using genes from animals in plant foods may pose ethical, philosophical or religious problems. For example, eating traces of genetic material from pork could be a problem for certain religious groups.
- Animal welfare could be adversely affected. For example, cows given more potent GM growth hormones could suffer from health problems related to growth or metabolism.
- New GM organisms could be patented so that life could become commercial property through patenting.

GM labelling and the law

Since December 2002, the law in Australia states that food labels must show if food has been genetically modified or contains genetically modified ingredients, or whether GM additives or processing aids remain in the final food.

Special labels are not required for:

- 'Highly refined' foods where the altered DNA or protein is no longer in the food (for example, oil from modified corn).
- GM food additives or processing aids - unless the new DNA remains in the food to which it is added.
- GM flavours where less than 0.1 per cent is present in the food.
- Food, food ingredients or processing aids where GM ingredients are 'unintentionally' present in less than 1.0 per cent.
- Food that is prepared at the point of sale (so takeaway and restaurant food will not have to be labelled).

Labels may be required where:

- Genetic modification has altered the food so that its composition or nutritional value is 'outside the normal range' of similar non-GM goods; for example, if GM technology is used to add vitamins.
- Naturally occurring toxins are 'significantly different' to similar non-GM foods.
- The food produced using GM technology contains a 'new factor', which can cause allergic reactions in some people.
- Genetic modification raises 'significant ethical, cultural and religious concerns' regarding the origin of the genetic material used.

GM food on the shelves

Many foods on supermarket shelves contain imported GM ingredients. A variety of GM foods have also been approved for production in Australia. Current applications and approvals, FSANZ. These foods include corn, soybeans, potatoes and canola. Others are still undergoing field trials approved by the Office of the Gene Technology Regulator (OGTR), although a recent moratorium by State Governments has stopped some field trials. Imported food products are subject to the same regulations as domestically manufactured foods.

There are around 20 GM foods, additives, flavourings, growth hormone (bovine somatotropin) and enzymes (like rennet, used to make cheese) currently approved in Europe. In the USA, there are more than 40 approved GM foods. The main sources of GM foods in Australia include:

- Imported soya from the United States. This is one of the main sources of GM ingredients in food sold in Australia since 1996. The soya has been genetically modified to be resistant to a herbicide. It can be found in a wide range of foods, such as chocolates, potato chips, margarine, mayonnaise, biscuits and bread. Cottonseed oil made from GM cotton (resistant to a pesticide) is also used in Australia. It is used for frying by the food industry, and in mayonnaise and salad dressings.
- Imported GM corn is mainly used as cattle feed at present and has not been approved for farming in Australia. However, GM corn may have entered the Australian market through imported foods like breakfast cereal, bread, corn chips and gravy mixes; if so, it is now required to be labelled.
- Other GM foods available overseas that may be ingredients in foods imported to Australia include potatoes, canola oil, sugar beet, yeast, cauliflower and coffee.

If you want GM-free food

Due to consumer demand, some food manufacturers in Australia have taken steps to provide GM-free food. These products may be labelled accordingly; for example, 'contains no genetically modified ingredients'. Although Food Standards Australia New Zealand (FSANZ) does not provide a consumer hotline on GM matters, people can make enquiries to the Gene Technology Information Service.

Where to get help

- Food Standards Australia New Zealand Tel. (02) 6271 2222
- Gene Technology Information Service Tel. 1800 631 276

Things to remember

- There are potential benefits, risks and ethical concerns regarding GM foods that are still being researched and debated.
- The health risks associated with consuming GM foods or ingredients have not been unequivocally established.
- There is no current evidence that suggests that GM foods are likely to be harmful to health.
- GM foods sold in Australia, or foods containing GM ingredients, are required by law to be labelled.

This page has been produced in consultation with, and approved by:

Deakin University - School of Exercise and Nutrition Sciences

Copyright © 1999/2009 State of Victoria. Reproduced from the Better Health Channel (www.betterhealth.vic.gov.au) at no cost with permission of the Victorian Minister for Health. Unauthorised reproduction and other uses comprised in the copyright are prohibited without permission.

- This Better Health Channel fact sheet has passed through a rigorous approval process. For the latest updates and more information visit www.betterhealth.vic.gov.au.