national union

Backgrounder

From the laboratory to your dinner table: Genetically Engineered Foods

Food for Thought

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Every day we make numerous decisions about the things we eat.

The availability of delicious and nutritious food is a vital concern for all of us. Every day we make numerous decisions about the things we eat. We weigh the various options in front of us and decide on the basis of our appetite and the possible health consequences of our choices. Should we eat that apple or buy a bag of potato chips? These are the types of questions we ask ourselves on a daily basis.

Food quality is an important aspect of the working life of many public sector workers.

For many public sector workers, these decisions about food take on a much broader nature. The recent events in the town of Walkerton highlight the importance of public sector workers in monitoring the quality of our food and water. Some examples are: the group home worker who is responsible for the nutrition of their clients; the dietitians, cooks and food preparation staff in institutions who set menus for hundreds of people; and, the food inspectors who make daily judgements on food made available to the public. And this can be even further extended to include the workers who order and purchase groceries for their public service or who set food policy for their workplace or community. Food quality is an important aspect of the working life of many public sector workers.

All public sector workers must be concerned about this type of industry-government collusion intended to prevent them from doing their job – serving the public.

As public sector workers, a significant part of our work is to provide services to the general public. In some cases this involves protecting them from danger or adverse effects of new products or practices. With the pressure from biotech corporations on government, we have seen repeated instances of government departments trying to silence the opinions of its employees. Health Canada scientists have been disciplined for attempting to bring public attention to what they see as a risk to the public. All public sector workers must be concerned about this type of industry-government collusion intended to prevent them from doing their job – serving the public.

For these reasons the National Union feels that it must participate in the broader campaign about GE foods. The first step is to provide educational materials to its members. It is important both to their individual health and in their role as defenders of the public interest. It's that simple – and complicated!

This paper is intended to provide a brief overview of the issue in an understandable and accessible manner. Often

discussion of these matters become jargon loaded and bogged down in technical language. It doesn't have to be. Many of the concepts are easy to understand and the implications just as straightforward to comprehend.

It is important to mention, at the onset, that the National Union shares many of the concerns of critics of the biotech industry. The potential health and environmental risks associated with the introduction of GE plants and animals suggest that extreme caution should be taken before and after they are introduced into the marketplace.

What is a Genetically Engineered Food?

Genetically Engineered/ Modified foods (GE) are those that come from seeds that have had their genetic makeup altered in some way by a scientist.

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All living things have genes in their DNA (deoxyribonucleic acid) which provide chemical instructions, or a map if you will, to how that organism will develop. The various characteristics of an organism are dictated by its genetic code. For example, whether someone will have blue or green eyes or the speed at which a tomato ripens.

GE attempts to both reduce the time required and introduce a far greater degree of control into the process. It involves taking a small piece of genetic code from a species' DNA and transplanting it into another.

Some variations within this genetic code can occur through natural processes. Hence, historically farmers have managed to breed new variations of traditional crops in order to emphasize specific characteristics (e.g. taste or appearance). This has always been a case of selective breeding within the same species or between "very closely" related species. Products like canola oil seed and bread wheat have arisen from the cross-breeding of species that are closely related.

The manner in which genes are passed from one generation of a species to another through sexual reproduction is not a direct transmission. Other genetic factors are involved which can mean that a resulting offspring resembles neither parent (in the same species). The same is true for traditional plant and animal breeding techniques. To selectively breed a new trait into a plant or animal can require a great deal of time and must take place in a variety of natural settings.

There have been some efforts to modify the nature of various plant species by exposing them to radiation or chemicals, selecting the most promising results and then selectively breeding these mutations. To date this has not proven to be significantly better than traditional breeding methods.

It is important to remember that these GE plants are different than anything else that existed before. While they may look, act and taste exactly like the normal item, they are actually the hybrid of two different species (sometimes extremely different).

GE attempts to both reduce the time required and introduce a far greater degree of control into the process. It involves taking a small piece of genetic code from a species' DNA and transplanting it into another. This is done so as to introduce a new characteristic into the species. For example, the genes from a jellyfish that are responsible for its ability to glow can be transplanted into a tomato. That tomato may now have the property of changing colour or glowing in the dark when it needs to be watered.

In this way food companies hope to introduce “beneficial” properties into the foods we eat. This could be a plant that exudes a pesticide, thereby reducing the amount of crop lost to insects. Or, it is a plant that is resistant to herbicides allowing a farmer to spray his fields to kill weeds without damaging the crop. In this way it is hoped that GE will: boost crop yields, provide fruits and vegetables that stay fresher on the shelf, resistant to diseases, and ....

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Just how is this done?

There are a number of ways in which foods are Genetically Modified. All of these techniques involve altering the DNA of a target plant or seed and then growing a number of these modified plants. Those plants, which best demonstrate the desired trait, are cultivated for commercial seed.

One technique makes use of the natural ability of a particular soil bacterium, Agrobacterium tumefaciens, to introduce small pieces of DNA into a plant. The bacterium uses this method to have the host plant produce the

necessary chemicals for its survival. What scientists have been able to do is introduce target DNA strands into the bacterium, which then proceeds to put it into the target plant species.

The most common means, called biolistics, makes use of a "Gene gun". A small piece of genetic material, chosen for a specific trait, is literally blasted into the cells of the target species carried along on a small piece of gold. In some instances a plant will accept the foreign DNA and start to follow the new genetic "road map".

Another of the most common methods makes use of plants that have had their tougher cell membranes (protoplasts) removed. Without the more resistant outer wall, foreign DNA can be introduced and there is a higher probability of it being taken up by the target plant.

How is this different than traditional methods?

The biotech industry argues that GE is nothing more than an extension of traditional methods of selective-breeding. It is true that new strains of plants and animals have arisen by selectively breeding two closely related species or variations within a species. But, there are four major ways in which GE differs from traditional plant/animal breeding.

Allows for the introduction of genes that could never take place through natural process.

a. *Allows for the introduction of genes that could never take place through natural process.*

   Plant breeding is almost wholly a process of reshuffling existing alleles, particular variants of a given gene, to achieve the desired traits. With only a few commercial exceptions, such as triticale (wheat crossed with rye), plant breeders work only with the genes they find already existing within their chosen species or closely related species that are able to cross.

   GE allows scientists to move whole genes and groups of genes across the barriers of species, genus, family, and even kingdom of life! Thus, the genes from a fish have been introduced into tomatoes; petunias into soybeans; and humans into cows. The major difference from traditional plant breeding arises in the

kinds of traits involved and the extent to which crop "modification" violates natural processes.

Haphazard insertion of a trait into a chromosome

b. *Haphazard insertion of a trait into a chromosome*

For conventional breeding practices the position that a given gene is ordered within a chromosome occurs in an orderly manner. Geneticists are only now realizing the role that the position of individual genes within chromosomes plays in their function and utility. Proximity and placement of given genes on a chromosome influence interactions among genes, and hence, their effectiveness, because genes do not operate in isolation.

With GE, the method used to insert the transgenes into the crop cells (e.g. using the gene gun or *Agrobacterium tumefaciens* methods) is inexact and haphazard - essentially a random occurrence. This can lead to all manner of confusion and difficulty for transgenic breeding programs affecting more than the desired trait.

New species introduced through traditional breeding techniques show stability over time…GE species often revert back to past forms. Natural DNA repair processes in a species' chromosomes will detect the alien genes and "fix" them.

c. *GE species show instability.*

New species introduced through traditional breeding techniques show stability over time. The new genes are not interpreted as abnormal or aberrant by the species' chromosomes. The new traits are relatively fixed and reliable over time.

On the contrary, GE species often revert back to past forms. Natural DNA repair processes in a species' chromosomes will detect the alien genes and "fix" them. Geneticists are only now beginning to understand the extent to which plants, and presumably the same is true with animals, chromosomes will find "mistakes" and deal with them.

d. *Everything under the sun is up for grabs – or is it?*

Contrary to hype, it now appears that GE can only introduce a few novel traits into a

The embracing of GE technologies is often a result of frustration with the length of time that traditional breeding practices take. There is a huge range of traits and capacities that can be introduced into a species using conventional methods – with a proven

given species. … species have evolved mechanisms for removing alien genes. That nature has evolved the means to do this should give us pause to consider the advisability of artificially introducing alien genes.

record of success. But the process can take years and involve multiple testing sites in the area in which the crop will eventually be grown.

Contrary to hype, it now appears that GE can only introduce a few novel traits into a given species. As was mentioned, species have evolved mechanisms for removing alien genes. That nature has generated the means to do this should give us pause to consider the advisability of artificially introducing alien genes. Despite all the hype and hyperbole about increased yield, and despite a mind-boggling amount of funding for GE research, field crop GE has not delivered on its many promises. Even the yields that were going to "feed the world" are actually less - not more - in GE crops.

Who is involved in doing this?

Research into GE foods is being almost entirely funded and promoted by a handful of multi-national corporations. Most prominent are Monsanto, Novartis, Dow and DuPont. As can be expected, profitability is the primary goal of these companies investment in GE foods.

Research into GE foods is being almost entirely funded and promoted by a handful of multinational corporations. Most prominent are Monsanto, Novartis[1], Dow and DuPont. As can be expected, profitability is the primary goal of these companies' investment in GE foods.

This has had a profound effect on the kinds of research being done. For example, one of the first GE foods to be most marketed is the "terminator seed". These are plants that have been altered to not produce usable seeds upon maturation. Historically farmers would raise a crop, collect as many seeds as possible for planting the next year, and then purchase those seeds necessary to meet their requirements. Using these seeds requires farmers to purchase them every year from Monsanto – obviously a benefit to the company but not the farmer or the consumer.

Another telling aspect of corporate involvement is the copyright restrictions placed on the seeds by corporations. Currently Monsanto is suing a Canadian farmer because they found some of his corn crop must have originated from their seed without being purchased from them.

Many of the characteristics being chosen for modification

[1] As of August 3, 2000, Novartis Consumer Health announced that it will not be using GE ingredients in its food products, worldwide. The do continue to produce and sell genetically modified Bt maize to farmers.

are specifically of benefit to corporate interests. Thus while it may sound good to have fruits and vegetables that stay fresher longer, when you think about it the result will be produce sitting on the shelf longer before being bought. This does not mean better quality food for consumers but does benefit food chains and wholesalers by increasing profits from produce remaining on the shelves longer.

But are they safe to eat?

The National Union sides with those who are critical of the rapid introduction of GE foods. Given the intricacies of human health and environmental processes it is hard to imagine that full and proper research has been done. Also, evidence is coming to light that gives us pause for concern. We strongly favour the "precautionary principle" – when in doubt it is best to err on the side of caution.

There is no easy answer to this question. Ultimately we just don't know. Obviously the corporations and GE food advocates say they are perfectly safe and that critics are fear-mongering. Critics say that the introduction of the technology is so recent that there was no time for proper research and study. Hence each side lines up their experts who soundly criticize and condemn the other.

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Critics point to a number of ways in which GE foods could adversely affect human health. These new products, some of which have never before been eaten by humans, can introduce unexpected allergens or hormones into the body. There are a couple examples of this already known.

In the early 1990s seed company Pioneer Hi-Bred introduced a GE soybean which had a strand of DNA from Brazil nuts in it. The new soybean was intended as feed for livestock. Quite quickly many industry and government agencies declared their support for the product and called for the waiving of federal testing. Fortunately the company realized that people allergic to Brazil nuts might also react to the new soybean. While the GE soybean might be intended primarily for livestock it is inevitable that some would find their way into foodstuff intended for human use.

Many scientists are concerned that GE modifications to a dietary supplement, L-trytophan, led to the deaths of thirty-

seven people. L-trytophan is an essential amino acid required by humans for the production of a number of chemicals in the brain. It has been used as a dietary supplement to treat symptoms of depression, sleep disorders and a number of other physical and psychological problems. The Japanese company Showa Denko K.K., unsatisfied with the historical method of producing it in a bacteria, used Genetic Engineering to boost production. Shortly after the product hit the shelves in 1989 nearly 1,500 residents of the United States were stricken with a mysterious ailment that caused severe muscle pain, heart problems, memory defects and paralysis. During the outbreak 37 people died! It is known that nearly all the victims had been taking Showa Denko's L-trytophan which was found to contain high levels of a number of toxic chemicals. To date there has been no conclusive evidence published to demonstrate that the GE L-trytophan produced the toxins, but there is a growing body of research which suggests it did.

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When you consider that many GE foods are altered to either produce their own pesticides or herbicides or make them extra resistant to commercially produced poisons the possible threat to health must be recognized. In either case you have increased levels of toxic chemicals originating from either the plant itself or from increased usage of agricultural poisons. Some studies have demonstrated that rats who were fed GE foods suffered from organ damage and depressed immune systems.

Are there possible environmental problems?

Again, this is a difficult question to definitively answer. As with concerns about the possible negative health effects, the National Union shares many of the fears of environmentalists. It is simply common sense to practice increased caution when dealing with the introduction of any new product – more so when they are GE species!

With the introduction of these crops farmers are going to be encouraged to heavily spray herbicides on their fields to kill weeds. The effects of the dumping of increased levels of these toxic

One of the most common environmental concerns associated with GE foods arises from the production of herbicide resistant plants. There are two sides to this concern:

chemicals in rural areas should be of concern to all of us.

1) with the introduction of these crops farmers are going to be encouraged to heavily spray herbicides on their fields to kill weeds. The effects of the dumping of increased levels of these toxic chemicals in rural areas should be of concern to all of us.

there are also fears that the GE plants will hybridize with closely related species and produce "superweeds" which will be invulnerable to any herbicide and can push out other plant species.

2) there are also fears that the GE plants will hybridize with closely related species and produce "superweeds" which will be invulnerable to any herbicide and can push out other plant species. For example, Monsanto has produced a species of wheat which is resistant to its commercial herbicide Roundup. It is expected that this "Roundup Ready" wheat will be available in the year 2002. The fear is that a very closely related weed called goat grass could pass its herbicide resistance to this plant. Many critics refer to this as genetic pollution and warn that this could result in dire environmental consequences.

There are other possible unintended hazards associated with GE foods. In 1999, scientists from Cornell University published an article in the magazine *Nature* warning that the pollen from GE corn ("Bt-laced") could be blown from farmers fields onto nearby milkweed plants and damage the larvae of insects such as monarch butterflies. The biotech industry dismissed the report but the Union of Concerned Scientists has called for a moratorium on the use of Bt corn until further research can be done. More recent research by from Iowa State University, published in the journal Oecologia, confirms that the potential effect on the larvae of monarch butterflies "may be substantial."

But what about the possible benefits?

The biotech industry is engaged in a massive public relations campaign to convince a skeptical public that GE foods are safe. An aspect of this campaign has to be industry spokespeople touting all the wonderful contributions, to a wide range of problems, that these new products could make. In this manner those individuals and organizations working to slow down, or outright prevent, the introduction of GE foods become depicted as opposing the eradication of hunger or an equally desirable outcome. But, as with everything related to food, this is a far more complicated matter than what is being presented.

GE foods will not alleviate world hunger

GE foods will not alleviate world hunger as many researchers have pointed out, the primary cause of hunger on the planet is not a shortage of food but poverty – a significant proportion of the world's population simply cannot buy food.

Industry spokespeople like to raise the specter of world hunger to demonstrate the need for biotechnology. They argue that GE crops are necessary if we are to produce enough food to feed a growing world population. But, as many researchers have pointed out, the primary cause of hunger on the planet is not a shortage of food but poverty – a significant proportion of the world's population simply cannot buy food. In fact most countries with the greatest number of underfed people often produce an over-abundance of food which ends up being exported to external markets by agri-businesses.

GE foods might even make the problem of world hunger worse. As the cost of food production rises, small farmers and peasants will be forced off their land by agri-businesses. These people in turn will have no choice but to migrate to cities in the hope of earning enough to survive – adding to the countries' poor. At a meeting of the FAO, delegates from African countries stated: "We strongly object that the image of the poor and hungry from our countries is being used by giant multinational corporations to push a technology that is neither safe, environmentally friendly, nor economically beneficial to us."

Ultimately the biotech industry is concerned about increasing its profits through GE foods. If there is a profit to be made from GE foods it is going to come through sales in the developed world and not through feeding the world's hungry. In order for GE foods to be profitable there will be an increase in: people displaced from their land; farmers dependent on biotech firms for seeds and chemicals; and, exports to developed nations. This does not suggest that poor people are going to be any better off anywhere in the world.

GE crops will not necessarily help farmers

The National Union's sympathies are completely with the independent

Small independent farmers are facing difficult times all over the world. In Canada there is a very real crisis among farmers with a dramatic rise in bankruptcies and severe debt loads. The biotech industry will often claim that GE crops will help small farmers be more profitable.

farmer. The crisis on the farm is a result of global economic forces – not due to a lack of efficiency on the farmer's part. Canada's farmers are extremely good at producing food for our tables – usually more than is needed. Larger crop yields have not solved the farmer's plight.

The reality is very much different.

The argument is that GE seeds will improve yields – meaning that the farmer will have more produce to sell on the market. There is increasing evidence that GE foods do not yield any better than normal crops. Indeed it appears that some of the GE crops, herbicide tolerant for example, may be more prone to fungal attacks, disease or insects. This in turn increases the need for chemicals to treat the problem arising from the GE crop. Furthermore, it is highly likely that pests and weeds will rapidly develop a resistance to the GE crops – requiring the introduction of yet another GE crop.

The National Union's sympathies are completely with the independent farmer. The crisis on the farm is a result of global economic forces – not due to a lack of efficiency on the farmers' part. Canada's farmers are extremely good at producing food for our tables – usually more than is needed. Larger crop yields have not solved the farmer's plight. It is unlikely that GE crops will yield larger crops or solve the crisis in farming communities. They will result in an increased dependency on the products of the biotech industry – for seed, herbicides, pesticides and fertilizer. This will likely make the problems worse for small farmers – eventually resulting in the increasing takeover of food productions by large agri-businesses.

How do we know if the food we are eating has been Genetically Modified? Are they labelled?

Unfortunately, food companies in Canada are not required to put the presence of GE foods on the labels of their products. This makes knowing whether there is genetically

Unfortunately, food companies in Canada are not required to put the presence of GE foods on the labels of their products. This makes knowing whether there is genetically modified substances in your food quite difficult. Researchers suggest that as much as 75% of all pre-packaged food have some GE content. Many of North America's staple crops, such as potatoes, corn, canola and soya, have been genetically modified. Mixed with other crops before being processed into food products means that a wide range of daily consumed goods (e.g. from potato chips to baby food) will contain GE content.

modified substances in your food quite difficult. Researchers suggest that as much as 75% of all pre-packaged food have some GE content.

The mandatory labelling of GE foods is an important aspect of the opposition to their introduction into the market. Understandably, given the public concern over the possible health effects of GE foods, the biotech industry is resisting efforts to require labelling. A recent opinion poll found that 90% of Canadians support the mandatory labelling of GE foods – but government has not acted on public demand. Instead government and industry have argued that mandatory labelling would be misleading and confusing to consumers. They suggest implementing a voluntary labelling protocol for the industry. But, voluntary labelling is likely to be more confusing to the consumer and does not compel companies to provide the information. It is unlikely that the producers of GE foods will voluntarily label their products.

Voluntary labelling would put the burden of proof in the wrong place. The biotech industry and its advocates would like the providers of traditional foods to prove claims of "GE-free", rather than accepting responsibility for honest labelling of their engineered foods.

Voluntary labelling would put the burden of proof in the wrong place. The biotech industry and its advocates would like the providers of traditional foods to prove claims of "GE-free", rather than accepting responsibility for honest labelling of their engineered foods. Rather than apply the stigma of GE to their own products, they would prefer to see "GE-Free" food become a niche market, one that will be less accessible to lower income earners and less available outside urban centers.

In the National Union's opinion the labelling provisions of the Food and Drugs Act, intended to ensure that consumers are provided the necessary information about the food they eat to make informed decisions, already require the Government to

In the National Union's opinion the labelling provisions of the Food and Drugs Act already require the Government to label genetically engineered food. Under the FDA, food must be labelled so that consumers are provided with the necessary information to make informed decisions about the food they eat. The National Union believes that the Government should strictly enforce the Food and Drugs Act and its regulations. To not do so is a flagrant abdication of the minister's duties.

Given the difficulty of identifying the presence of GE foods in our daily diets means that their potential health effects will be similarly difficult to determine. If these products are to be proven safe, or harmful, there must be full, mandatory labelling. Ironically, Canada stringently regulates drug products, even though they are typically used sparingly and usually under a physicians directions. On the other hand GE foods are subjected to lax regulation even though they are eaten everyday in large quantities by most of the population. It is a great cause for concern that GE foods

label genetically engineered food. The National Union believes that the Government should strictly enforce the Food and Drugs Act and its regulations. To not do so is a flagrant abdication of the minister's duties.

have been inadequately tested and that the results of any testing done are unavailable to the general public.

The global regulatory trend is toward mandatory labelling. Mandatory standards are currently in place, or are being developed, in the 14 member countries of the European Union, as well as in Australia, New Zealand, Japan and Korea. In the United States there is growing political pressure for mandatory labelling and many analysts expect to see regulations in place in the very near future. It is time that Canada requires food companies to inform consumers about the presence of GE food in their products.

What can we do?

For all the reasons provided in this paper, the National Union supports the growing movement of people and organizations opposed to the introduction of GE foods. The risks seem too great and benefits over-hyped.

This is an issue that we can win! There is growing international movement opposed to GE foods. National Union members can join the national campaign calling for:

- an immediate moratorium on the introduction of GE crops and foods;
- long-term independent testing of all GE crops before approval will be considered;
- strict health and environmental criteria before new GE products are approved;
- proper mandatory labelling of all GE foods; and
- a food safety regulatory system that puts public health ahead of corporate profits.

Get active:

- join an existing group or start your own;
- pass a resolution in your local – forward a copy to your local supermarkets;
- write an article for your local's newsletter;
- invite a speaker to your local's next membership meeting;
- target a supermarket in your area;
- ask the supermarket to label all GE foods or take GE foods off the shelves;
- take further action if, in the end, they refuse.

Where should I look if I want to learn more?

There is a lot of excellent material available. The following web sites are recommended:

http://www.cspi.org/

http://www.canadians.org/ (under campaigns check out the GE Alert site)

http://www.healthcoalition.ca

http://www.sierraclub.ca/national/genetic/index.html

http://www.greenpeacecanada.org/e/home.html

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