Submission ("Interested Person") Form 1

Royal Commission on Genetic Modification

1. Name of Organisation/Person accorded "Interested Person" Status

GE Free New Zealand (RAGE) In Food and Environment Incorporated

2. Submission Executive Summary

Executive Summary

Provide an overarching summary of your submission and recommendations made [in respect of items (1) and (2) of the Warrant]. The Executive Summary should be no more than **3** pages in length

Please note that individual section summaries will be required and therefore the Executive Summary should focus on summarising the issues addressed in the submission and provide cross references to the sections in which the issues are covered rather than summarising the substantive content

GE Free New Zealand makes recommendations in terms of A (1) and (2) of this reference. These recommendations are substantiated by the evidence provided in the rest of this submission and by the accompanying witness briefs. We believe that this submission contains strong evidence in support of our recommendations in A (1) and (2). We also consider that these recommendations are reflective of the wishes of the New Zealand public.

In this submission we have used the term 'genetically engineered' to refer to genetic modification. Overseas, the use of the term 'genetically modified' is more commonly used and therefore some of our witness briefs may contain the term 'genetically modified'.

This submission focuses on the risks of genetically engineered organisms in our food and our environment. This specifically refers to the use of genetic engineering technology in methods of food and agricultural production. (Section B j (i) (ii).

Attached witness briefs of Joseph Cummins and Maewan Ho address these topics in further depth.

The witness brief of Jon Carapiet addresses issues related to consumer perceptions, marketing New Zealand internationally, consumer concerns with GE Technology, the future of GE in Food, alternative approaches, trade issues, consumer rights and cultural values.

The witness brief from Steven Druker addresses issues about the safety of genetically engineered food with particular reference to a lawsuit taken out against the FDA. Documents referred to can be found at www.biointegrity.org

In respect of this submission, we would like to highlight the following points:

⇒ Genetically engineered organisms are a completely new technique and differ greatly different from conventional techniques. Risks in biotechnology need to be treated as requiring special safety procedures. No viable safety procedures exist which can contain the risk of genetic pollution.

⇒ Proponents of Genetic Engineering in Agriculture often claim this technology is necessary to feed the world. A new report by the FAO shows this not to be true. Estimations and projections are given.

⇒ In respect of Section A (1) and (2) we consider that there should be an immediate and indefinite ban on the release of genetically engineered foods in our food supply or in our environment. Derivatives of genetically altered organisms or genetic engineering processes should not be exempt from this.

⇒ We consider that it is dangerous and extremely unwise to allow such hazards into the food chain. The potential for disease creation is too great. We consider that the potential threats to human health we have discussed in this submission to be immense. We oppose the introduction of genetically engineered food or their derivatives into the human or animal food chain.

⇒ In addition, GE Free New Zealand considers that the potential risks to the environment from the release of genetically engineered plants, crops, and animals is unacceptable. We believe that these risks are too large in their possible impact and ramifications to make the introduction of genetically engineered crops, plants and animals into the environment an option. We oppose the introduction of all and any genetically engineered crops, plants and animals into the environment because of the unacceptable level of risk this would pose and because of the irreversible nature of this technology in agriculture.

⇒ GE Free New Zealand considers that major changes in legislation, regulations and policy changes are necessary to reflect the adoption of our recommendations in section A (1) and A (2) from this submission under the terms of reference.

⇒ We believe that there are many avenues for research into sustainable development which should be funded by government as an alternative to funding research into biotechnology in agriculture.

⇒ We consider that the most sustainable option for New Zealand is the avoidance of genetic engineering in agriculture production. The expansion of organic agriculture will be the best strategic outcome for New Zealand.

⇒ Opportunities available to New Zealand from the avoidance of genetically engineered crops and animals would be the adoption of organic agricultural methods. There is increased world-wide demand and growth in this sector, which is most likely to continue and increase.

⇒ GE Free New Zealand believes that the Crown has a responsibility under Article 2 of Te Tiriti O Waitangi to protect indigenous flora and fauna. This can be best assured by the adoption of genetically engineered free agricultural production methods.

GE Free New Zealand believes the most desirable option is for the Royal Commission on Genetic Modification to recommend that New Zealand places an immediate and indefinite ban on the release of all genetically engineered food crops and animals in our environment, and on the presence of all genetically

engineered food and its derivatives in our food supply. We believe this stance to be justified in light of the evidence presented here and also to be reflective of the wishes of the New Zealand public.

3. Witness Briefs Attached

Witness Briefs

Provide a numbered list of the names and positions of witnesses from whom briefs are attached, including an indication as to whether or not you intend to present the witness at the formal hearings

Witness briefs must be provided to the Commission with your submission

Witness briefs should be prepared on Form 2

1. Dr Maewan Ho – will present evidence at the formal hearing via video link
2. Steven Druker – will present evidence at the formal hearing in person
3. Professor Joe Cummins – will present evidence at the formal hearing via video link
4. Jon Carapiet – will present evidence at the formal hearing in person

4. Submission by Section (as specified in the matters set out in the Warrant)

Submission by Section

Submissions are to be structured in line with the matters specified in the Warrant and the sections numbered accordingly

Each section should stand alone, and include a Section Summary, identifying the issues addressed in the section

Submissions may address all or only some of the sections (as specified in the Warrant). However section numbers should be retained, for example, if a submission addresses matters (a), (c) and (e), the sections shall be numbered (a), (c), and (e), rather than a, b, and c

Submissions may, within each section, adopt a sub-section approach using different headings; however, each paragraph should be consecutively numbered

Section A Recommendations

The Warrant has set the Commission the task of receiving representations upon, inquiring into, investigating, and reporting on the items set out in Section A (1) and (2) below

Section A (1)

A (1) the strategic options available to enable New Zealand to address, now and in the future, genetic modification, genetically modified organisms, and products

Section A (1) Summary

GE Free New Zealand (RAGE) In Food and Environment Incorporated considers it is imperative that New Zealand adopts an immediate and indefinite ban on genetically engineered organisms in our food and our environment. This is because there is insufficient independent and long-term research into the risks of this technology in food and organisms and because there are clear indications of extreme hazards to both human and environmental health (1.1) (1.2)
New Zealanders recognise the need for extreme caution with this technology. (1.3) (1.4)
We dispute that there will ever be sufficient research to properly evaluate these risks. We consider that the most beneficial and best strategic option is to expand on organic methods of agriculture for both the health of our environment and our people, and for the health of our economy. (1.5)

SECTION A (1)

1.1 GE Free New Zealand (RAGE) In Food and Environment Incorporated considers that New Zealand has only one strategic option available when considering the use of genetically engineered technology in our food and environment. Which is:

- the immediate adoption of an indefinite ban on all genetically engineered food, crops and animals because of the risks to human health and to the environment and because of the irreversible nature of this technology when applied to agricultural production.

1.2 GE Free New Zealand believes that this indefinite and immediate ban on all genetically engineered food, crops and animals in our food and environment in necessary because we dispute that there will ever be sufficient long term and independent scientific research which will guarantee the safety of genetically engineered food, crops and animals. This is due to the lack of scientific knowledge about the complexities of DNA and the technology itself, and because it is difficult to conduct research into possible risks of this technology, when the risks themselves are unknown. Possible effects, which may come to light during research, could be limited to those anticipated and not take into account those risks, which are not expected or anticipated or known, to the researchers. Furthermore, the use of this technology in agriculture is unnecessary and inherently hazardous.

1.3 GE Free New Zealand (RAGE) in Food and Environment Incorporated has seen a huge public response to the issue of genetically engineered organisms. GE Free New Zealand (RAGE) In Food and Environment has been talking with members of the public for over two years and has concluded that the New Zealand public realises the enormity of the decision with regards to the adoption or avoidance of genetic engineered crops, food and animals. In all of our meetings and discussions, New Zealanders have expressed the need for extreme caution related to the adoption of this technology.

1.4 This caution is appropriate due to the irreversible nature of this technology when in the environment and the possible effects on human health and the contamination of the nation's food supply.

1.5 Due to the irreversible nature of this technology, GE Free New Zealand (RAGE) in Food and Environment Incorporated considers that New Zealand's only option is to proceed with caution, therefore avoiding the use of genetically engineered agriculture and to expand other sustainable methods of crop and animal production i.e. organic agriculture. This adoption would be the most beneficial and optimum strategic direction for New Zealand and would improve the health of the environment, New Zealand citizens and our economy.

Section A (2)

A (2) any changes considered desirable to the current legislative, regulatory, policy, or institutional arrangements for addressing, in New Zealand, genetic modification, genetically modified organisms, and products
Section A (2) Summary Changes should be made in all aspects of legislation, regulations, policy and institutions which reflect the adoption of a genetically engineered free New Zealand in both food and the environment. These changes should be put into place immediately. (2.1)

A (2)

2.1.GE Free New Zealand (RAGE) In Food and Environment Incorporated considers that legislative, regulatory, policy and institutional arrangements should be revised to reflect the strategic approach of a genetically engineered free food and environment in New Zealand, where no food crops, plants or animals derived from genetically engineered technology are grown or released in the environment, including the deletion of controlled field trials of such organisms or commercial release of said organisms. These changes should be put into place immediately.

Section B Relevant Matters

The Warrant has set the Commission the task of receiving representations upon, inquiring into, and investigating, the matters set out in Section B (a) – (n) below

Section B (g)

B (g) the Crown's responsibilities under the Treaty of Waitangi in relation to genetic modification, genetically modified organisms, and products

Section B (g) Summary
GE Free New Zealand believes that the Crown has a responsibility under Article 2 of Te Tiriti O Waitangi to protect indigenous flora and fauna. This can be best assured by the adoption of genetically engineered free agriculture. (1.1)

B (g)

1.1 GE Free New Zealand (RAGE) in Food and Environment Incorporated believes that the Crown has rights and responsibilities under Article 2 of Te Tiriti O Waitangi to protect taonga (treasures) of New Zealand. This includes indigenous flora and fauna of New Zealand. This can be assured by the adoption of a genetically engineered free agriculture in New Zealand, eliminating the risk of environmental impacts from this technology.

Section B (h)

B (h) the global developments and issues that may influence the manner in which New Zealand may use, or limit the use of, genetic modification, genetically modified organisms, and products

Section B (h) Summary
Proponents of Genetic Engineering in Agriculture often claim this technology is necessary to feed the world. (1.1)
A new report by the FAO shows this not to be true. Estimations and projections are given. (1.2) (1.3) (1.4)

B (h)

1.1 Proponents of genetically engineered organisms often state that this technology is needed in order to meet the growing demand on our world's food supply, and that it will be necessary in order to produce enough crops to 'feed the world'. Robert Shapiro (at the time of article publication was the Chairman and Chief Executive Officer of Monsanto) states in an article in the Futurist Magazine in 1999 that there are only two ways to feed the growing world's population: one of these being biotechnology.

1.2 However a new report from the United Nations' Food and Agriculture Organisation (FAO) concludes that this is not the case. The current calculations of world population by the United Nations is set at 1.3% growth in the late 1990s with a slowly declining rate over the next thirty years, as low as 0.7%. By 2050 it is expected that the population growth rate will be as low as 0.3%. The 1998 projection of world population in 2010 is 6.8 billion (FAO, 2000).

1.3 The report by the FAO considers that using current agricultural methods (which do not include genetic engineering technology) there will be sufficient food produced to meet the population growth predicted over the next thirty years. It asserts that current world crop production will still continue to exceed the overall population growth and our increased consumption for food (FAO, 2000).

1.4 This report by the United Nations FAO illustrates that genetic engineering technology is not necessary in order to 'feed the world' as many biotechnology companies and organisations would claim.

References

Shapiro, Robert (1999) 'How Genetic Engineering Will Save Our Plant', *Futurist,* 33 (4) April, 28-9.

Food and Agriculture Organization (FAO) of the United Nations, Economic and Social Department, (2000) *Agriculture: Towards 2015/30,* Technical Interim Report, April, 249pp.

Section B (i)

B (i) the opportunities that may be open to New Zealand from the use or avoidance of genetic modification, genetically modified organisms, and products
Section B (i) Summary Opportunities available to New Zealand from the avoidance of genetically engineered crops and animals would be the adoption of organic agricultural methods. There is increased world-wide demand and growth in this sector, which is most likely to continue and increase. (1.1) (1.2) (1.3)

B (i)

1.1 GE Free New Zealand (RAGE) in Food and Environment Incorporated sees the most desirable strategy for New Zealand is to adopt complete avoidance of genetically engineered crops, food and animals, with a view to expanding our organic and genetically engineered free agricultural methods. Public reaction in Europe has seen a strong resistance to genetically engineered organisms used in the food supply (Frozen Food Age). Along with this reaction, has come the increased consumption of organic food. Currently New Zealand has an extremely lucrative and prosperous organic export and domestic market. Survey results show that New Zealand's organic export market was worth over NZ $60 million in the year 1999-2000 (OPEG Member Survey, 1999 – 2000).

1.2 This is a significant increase from the previous year's figures, showing a 77% increase. In addition, world-wide demand for organic products is estimated to increase by 20% per annum, making organic food production the fastest growing areas in food production globally. Current organic market figures have sustained this growth for the last five years (OPEG Member Survey, 1999 - 2000).

1.3 Demand for agricultural products, which are free from genetically engineered technology, has also increased globally, particularly in European markets. If New Zealand were to place a ban on the growing of all genetically engineered crops, we would be in a position to satisfy Europe's demand for genetically engineered free crops. Monsanto themselves advise that conventional genetically engineered free food will become more expensive because it will be more difficult to source (Bentley, 1998). As an isolated island, New Zealand would be in an extremely beneficial position to produce both organic and genetically engineered free agriculture.

References

'British Retailers Move to Scrap Genetically Modified Products', *Frozen Food Age* 47, no. 10:58.

'Significant Increase in Organic Exports From New Zealand', *OPEG Member Survey 1999-2000,* http://www.organicsnewzealand.org.nz/documents/survey2000.htm

Bentley, S. (1998) "Monsanto Warns of High Prices for "Natural Foods"', *Marketing Week,* 21, no.15: 8.

Section B (j)

B (j) the main areas of public interest in genetic modification, genetically modified organisms, and products, including those related to:

(i) human health (including biomedical, food safety, and consumer choice)

(ii) environmental matters (including biodiversity, biosecurity issues, and the health of ecosystems)

(iii) economic matters (including research and innovation, business development, primary production, and exports)

(iv) cultural and ethical concerns

Section B (j) Summary

This Section addresses B (j) (i) and B (j) (ii)

B (j) (i)

1) Background to Health Concerns (1.0 - 1.4)
2) Introduction and overview of health hazards - importance of the issue (2.0 – 2.4)
3) Safety assessment of biotechnology (3.0 – 3.7)
4) Health hazards of genetically modified foods (4.0 – 4.12)
    Unpredictable mutation of the genetic blueprint of life
    Unnatural gene transfers from one species to another are dangerous
    Unpredictable health damaging effects and new diseases
    Summary of risk pathways (diagram)
5) Genetically engineered products carry more risks than traditional foods (5.0 – 5.4)
6) Traditional medicine and genetic engineering (6.0 – 6.8)
7) Assessment of the extent of health hazards from genetic technology (7.0 – 7.18.3)
    Diet and disease
8) Pesticide and herbicide residues, health, and food shortages (8.0 – 8.9.7)
    Pesticide-producing genes in food
9) Toxicology and safety testing (9.0 – 9.10)
10) Genetic engineering and consciousness (10.0 – 10.7)
11) Risks of horizontal gene transfer (11.0 – 11.5)
12) Conclusion of Health Section (12.0)

B (j) (ii)

1) Differentiation Between 'Contained Use' and 'Releases' into the Environment (1.0 – 1.2)
2) Genetically Engineered Crops, Plants and Animals Are Different from Conventional Breeding (2.0 – 2.3)
3) Effects on Other Species From Genetically Engineered Plants, Crops and Animals (3.0 – 3.2)
4) Biodiversity (4.0 – 4.2)
5) Conclusion (5.0)

See also attached witness briefs from Dr Maewan Ho and Professor Joseph Cummins and Steven Druker.

SECTION B (j) (i)

1.0 Background to Health Concerns

This section raises important concerns about the safety and health hazards of genetically modified foods and genetic engineering procedures. Health is fundamental to life, without the assurance of health and safety, genetic engineering is a bridge too far, unacceptable to the public and to anyone concerned about life.

1.1 The twentieth century has seen a continuous expansion of industrial, medical, food, and agricultural chemical production without precedent in history - a chemical revolution. By the 1970's, new chemicals and compounds were being registered at a rate of more than 200 a week. At first, very little attention was paid to the possible health hazards. The prevailing toxicological paradigm

called for minimal testing on animals of anything destined for human consumption in order to detect short-term poisoning. This safety paradigm has proved totally inadequate to control an unprecedented expansion in the incidence and diversity of chronic degenerative illness. Many of the industrially produced chemicals have been implicated as causative factors (PCBs, asbestos, DDT, thalidomide, Agent Orange, etc), many more are suspected, but the sheer complexity of identifying the causes of illness defies the best researchers. This is because so many chemicals and pollutants are involved and because of the many years and huge numbers of subjects needed to complete medical research of this kind.

1.2 Moreover, chemicals perform differently under a range of circumstances. Earnest scientists ate spoonfuls of DDT at early press conferences to prove its safety, little realising that its toxic effects didn't manifest properly until dissolved in oil solvents, a process needed for its application. Despite the obscurity surrounding causative factors in illness, the known examples are frightening enough. More and more causative factors are being identified as time goes on. For example, the use of hard fats in food has recently been tied to the high incidence of heart disease - the number one killer in the twentieth century. Hard fats produced by chemical hydrogenation were introduced at the turn of the century to make butter substitutes which are now used in thousands of breads, biscuits, sweets and processed foods. The epidemic of heart disease has grown as the use of hard fats increased, however it was not until 100 years had passed that researchers were able to show, and then only tentatively, that the consumption of even 5 gms of hard fats a day (the amount in two biscuits) increases a woman's chance of having a heart attack by age forty by 40%.

1.3 No one knows for sure which factors cause or complicate the cancers, asthma, and a host degenerative illnesses that plague the industrialised world. It is known that their incidence clusters around centers of urban, industrial and agrichemical pollution. In crowded or industrialised countries or areas found in Britain, Russia, or India etc new illnesses and allergies are springing up with alarming regularity around housing built on landfill or reclaimed industrial land or near to established industries, but in most cases no one knows quite what causes them. The clean-up of these polluted sites is a monumental task which extends right down to the water table, a conduit to spread disease and pollution to all.

1.4 We now stand on the brink of another revolution - the genetic revolution. In this case, the health prospects are bleak, if not hopeless unless we act now to halt genetic experiments. This is because biochemical pollution, unlike chemical of nuclear pollution, can reproduce itself. Inevitable mistakes and accidental or deliberate releases can spread without limit. They can never be cleaned up. They cannot be contained. Moreover biochemical pollution can invade and undermine the very structure of life itself. Unless genetic engineering which is daily producing new compounds at a rate which dwarfs chemical discovery, is stopped now, we are placing at grave risk millions of years of evolution and the whole human endeavour of knowledge, happiness, and spiritual progress. This submission explains these concerns and scratches the surface of the potential hazards to health.

2.0 Introduction and overview of health hazards - importance of the issue:

Informed comment:

2.1 Dr Erwin Chargoff, an eminent biochemist who is often referred to as the father of molecular biology, warns that the technology of genetic engineering poses a greater threat to the world than the advent of nuclear technology. *"I have the feeling that science has transgressed a barrier that should have remained inviolate,"* he wrote in his autobiography, Heraclitean Fire. Noting the 'awesome irreversibility' of genetic engineering experiments, Chargoff wrote, *"...you cannot recall a new form of life...It will survive you and your children and your children's children. An irreversible attack on the biosphere is something so unheard of, so unthinkable to previous generations, that I could only wish that mine had not been guilty of it."*

2.2 The danger of new toxins, allergens, and diseases in foods that were previously naturally safe has to be taken very seriously. An unfolding research effort is identifying more and more serious risks inherent in biotechnology foods. These discoveries are causing a loss of consumer confidence in regulatory procedures and safeguards, but more importantly, they open up the near certainty of wide-scale public health problems.

2.3 Four years ago the NGOs in New Zealand and abroad produced sound scientific arguments to support their case that GMOs were poisonous to the environment and human health. At the time, few safety experiments had been started; consequently only a handful of qualified geneticists were willing to raise their voices in support. Now in 2000, it is quite clear from the mounting volume of evidence and resulting calls from thousands of concerned scientists and medical experts around the world, that GMOs really are as harmful as we proposed. The introduction of GMOs poses a total threat to the stability of the environment and the human physiology. Harmful effects of genetic modification and/or genetic dysfunction demonstrated in micro-organisms, plants, animals, humans, the environment, and the economy now include:

2.3.1 Disruption of the timing and amount of gene expression

2.3.2 Disruption of gene regulation mechanisms

2.3.3 Disruption of genetic sequence and function

2.3.4 Disruption of functions of 'families' of genes

2.3.5 Distortion of molecular shape causing ‘BSE’ category diseases

2.3.6 Introduction of toxic and allergenic proteins into diet

2.3.7 Lesions and irritation of the intestinal tract and other organs

2.3.8 Spread of antibiotic resistance jeopardising medicine

2.3.9 Instability and mutation (cancer) of the organism

2.3.10 Compromise of the immune system & hormonal balance

2.3.11 Viral recombination creating new viral illnesses

2.3.12 Toxic shock leading to rapid death among experimental gene therapy patients

2.3.13 New transfer pathways for diseases to cross species barriers

2.3.14 Links between increased incidence of serious illness and consumption of GMOs

2.3.15 Disruption of self-repair mechanisms of DNA

2.3.16 Disruption of quantum mechanical or field properties of DNA

2.3.17 Interference with holistic functions of DNA (consciousness)

2.3.18 Vectors and/or plasmids invading sperm cells causing new genetic defects

2.3.19 Threat to both the longevity and survival of all species

2.3.20 Transfer of genetic mutation over long distances through cross pollination

2.3.21 Interference with healing properties of plants

2.3.22 Secondary toxicity along the food chain depleting beneficial insects

2.3.23 Increased use of pesticides

2.3.24 Instability of the GM plant varieties and susceptibility to climatic extremes

2.3.25 Reduced crop yields and prices

2.3.26 Reduced crop exports and total trade bans

2.4 Under the New Zealand Health Act, the government has a duty 'to protect and promote public health'. Instead, public money is being used to fund biotechnology projects in our universities and government agencies. Fifty years ago, scientists promised that pesticides and nuclear power would provide a safe, bright future. Today biotechnologists are promising a healthy, abundant future; but research demonstrates that genetic pollution is the greatest threat ever to life on our planet, inevitable mistakes will spread without limit and can never be cleaned up. Therefore, only a total ban on genetic engineering can ensure a safe healthy future for humankind. The following sections explain in detail how the above list of hazards have arisen.

3.0 Safety assessment of biotechnology

3.1 The risks associated GE foods are greater than previously thought. More stringent risk assessment principles need to be used when risks are present for all time as is the case with viable GE organisms.

3.2 The Environmental Risk Management Authority (ERMA) and the Australia New Zealand Food Authority (ANZFA) are operating case by case assessments of biotechnology food products whereby most gene-altered foods are passed as safe with minimal testing and sold to the unsuspecting public without health warnings to identify these novel food risks. The safety assessment procedures involve no long term health testing of novel foods. Therefore the ERMA and ANZFA regulatory framework is prima facia inadequate to protect consumers from health hazards.

3.3 Traditionally, safety assessment of foods has relied on the concept of 'long term usage'. If a food has been eaten over a very long period without any apparent ill effects then it is assumed safe. Given their novelty, foods produced through biotechnology pose some special challenges in deciding on

safety. Increasingly scientists are suggesting that safe testing procedures are in principle impossible to design. No rational mathematical method exists for calculating the risks of genetic releases and foods, therefore assessment procedures of ERMA are in effect bogus and contrary to New Zealand law. The more so because viable whole foods will be able to reproduce themselves and therefore any deliberate release of such organisms will continue to affect the consumer and the environment for all time.

3.4 Simply put, unlike nuclear or chemical pollution, genetic pollution can never be cleaned up, inevitable mistakes will be passed on to all subsequent members of a species. This is all the more serious because DNA, which is altered by genetic engineering, is absolutely fundamental to health - DNA creates and governs the flow of biological intelligence in every level of the physiology of every organism.

3.5 Calls for careful testing procedures are challenged by some biotechnology advocates on the grounds that the risks posed by some new biotechnology products may be very small. However, by applying correct statistical rules of risk assessment we are forced to conclude that even a very small risk is magnified to a near but unquantifiable certainty when a new food will be present in the environment and consumed for all time. Fields containing millions of plants with novel genes later consumed by millions of people at every meal will magnify risks such as those associated with horizontal gene transfer to unprecedented levels. In any case, our ensuing discussion will demonstrate that the risks are not small.

3.6 **Therefore risks in biotechnology need to be treated as requiring special safety procedures. In fact no viable safety procedures exist which can contain the risk of genetic pollution.**

3.7 Informed comment:

Professor Richard Lacey, microbiologist, medical doctor, and Professor of Food Safety at Leeds University has become one of the best-known figures of food science since his prediction of the BSE crisis made more than ten years ago. In 1995, Professor Lacey spoke out strongly against the introduction of genetically engineered foods, because of 'the essentially unlimited health risks' - *'The fact is, it is virtually impossible to even conceive of a testing procedure to assess the health effects of genetically engineered foods when introduced into the food chain, nor is there any valid nutritional or public interest reason for their introduction.'*

Scientific references:

Transgenic crops: USDA data on small-scale tests contribute little to commercial risk assessment, Mellon, M. & Rissler, J. Bio/Technology, 13:96, 1995

4.0 Health hazards of genetically modified foods

4.1 There has been no testing for long term health risks of GE foods. Genetic engineering causes an unpredictable pattern of mutation of the genetic blueprint of life that can generate new toxins, allergens, and diseases from foods that were previously naturally safe.

4.2 It is necessary to review the risks for health when novel foods are ingested by people and animals. Recent research suggests that health risks are greater than previously thought. These risks arise in a number of ways.

4.3 Unpredictable mutation of the genetic blueprint of life

Given the huge complexity of genetic coding, even in very simple organisms such as bacteria, no one can possibly predict the effects of introducing new genes into any food. Therefore there is no way of knowing the overall, long-term effect on health.

This is because:

4.3.l the transposed gene may act differently when working within its new host

4.3.2 the original genetic intelligence of the host will be disrupted

4.3.3 the new combination of the host genes and the transposed gene will have

unpredictable effects.

4.4 Unnatural gene transfers from one species to another are dangerous

Cross-species transfers being made between unrelated species, such as the transfer of modified agrobacterium genes, viral genes, and antibiotic resistant genes, would not happen on a large scale in nature and may create new toxins, diseases, and weaknesses. In this risky experiment, the general public will be the ultimate guinea-pig. Biotechnology industry advocates claim their methods are precise. In fact, there is a random element in all current gene insertion methods. Genetic research shows that many weaknesses in plants, animals and humans have their origin in tiny imperfections in the genetic code. Therefore, side-effects and accidents are inevitable, and some scientists have assessed the risks to be unlimited.

Scientific references:

Palmiter, R.D. et al (1986) Annual Review of Genetics **20**: 465;

Inose, T. et al (1995) Int. Jour. Food Science Tech. **30**:141.)

4.5 Informed comment:

Dr Peter Wills, theoretical biologist and senior lecturer in physics at Auckland University writes: *'Genes encode proteins involved in the control of virtually all biological processes. By transferring genes across species barriers which have existed for aeons between species like humans and sheep we risk breaching natural thresholds against unexpected biological processes. For example, an incorrectly folded form of an ordinary cellular protein can under certain circumstances be replicative and give rise to infectious neurological disease'.*

4.6 Unpredictable health damaging effects and new diseases

New research findings demonstrate that virus fragments used to facilitate transfer of genes can easily recombine with other genetic material to reactivate their potential to cause illness.

4.7 When genetic engineers insert a new gene into any organism there is a 'position effect' which entails an unpredictable pattern of genetic function. The protein product of the transposed gene may carry out unexpected reactions and produce toxic products. There is also serious concern about the dangers of using genetically engineered viruses as delivery vehicles (vectors) in the generation of transgenic plants and animals. This could destabilise the genome and lead to horizontal gene transfer to other species, including mammals. This risk is known because recent research suggests that disabled viral material used in recombinant DNA techniques can recombine with other viral material in plants or in the human or animal gut to produce new active forms of viral material.

4.8 **Research findings reported in August 1997 show that one in eight genetically engineered cucumbers exhibited genetic recombination leading to reactivation of disabled viral material.** This may cause dangerous new diseases, resistance to antibiotics, and severe immune reactions.

4.9 Contrary to what was previously thought, new research shows that viable genetic sequences can survive digestion, enter the bloodstream, and invade cells where they have the potential to disrupt physiological functions and cause new illness.

4.10 Moreover, it is now clear that long sequences of genetic information contained in foods are absorbed directly by rodents through their digestive tract into their blood stream and then incorporated into cellular structures. Research in the United States has shown that vector genetic sequences have began to appear in the reproductive cells of animals and in one case human sperm. Therefore the role that genetic sequences play in digestion, tissue generation, and disease formation has thus been opened up for reevaluation. It has been suggested that alterations to genetic sequences of food may carry even higher risks than previously thought.

4.11 When unusual genetic structures are inserted into recognisable food sequences, cell-based immune protective mechanisms may be bypassed, fooling the cell into accepting poisonous genetic sequences that it normally would have rejected. Genetic engineering also interferes with RNA editing and molecular folding which may cause the formation of prion-based diseases similar to BSE - mad cow disease. CJD, the human form of BSE, has now been demonstrated to have an incubation period of up to fifteen years. This shows that serious health hazards of gene-altered may take years to come to light. **Therefore there should be a ban on the release of genetically engineered foods.**

Scientific references:

Suffer the children, Boyce, N., New Scientist, 14 March 1998

Fields of genes. Kleiner, K. New Scientist , 16 August, 97.

Recombination between viral RNA and transgenic plant transcripts. Greene, A.E., Allison, R.F. Science, 263, 1423-1425, 1994.

Osbourn, J.K. et al (1990) Virology 179:921

Gal, S. et al. Virology 187:525, 1992

Are current transgenic technologies safe? Ho, Mae-Wan Paper prepared for the Workshop on Capacity Building in Biosafety for Developing Countries, May 22-23, 1996. Available from: Professor Mae-Wan Ho, Biology Dept., Open University, Walton Hall, Milton Keynes, MK7 6AA, UK.

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Ingested foreign (phage M13) DNA survives transiently in the gastrointestinal tract and enters the bloodstream of mice. Schubbert, Lettman, and Doerfler Mol. Gen. Genet. 242, 495-504, 94.

Can DNA find its way into cells? New Scientist, 4th January 1997

Uptake of foreign DNA from the environment: the gastrointestinal tract and the placenta as portals of entry. Doerfler, W. and R. Schubbert. Wiener Klinische Wochenschrift. 110/2:40-44, 1998.

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On the fate of orally ingested foreign DNA in mice: chromosal association and placental transmission to the fetus. Schubbert, R., et al. Mol. Gen. Genet. 259:569-576, 1998.

4.12 Informed comment:

Dr Joseph Cummins, Professor Emeritus of Genetics at the University of Western Ontario warns: *'Probably the greatest threat from genetically altered crops is the insertion of modified virus and insect virus genes into crops. It has been shown in the laboratory that genetic recombination will create highly virulent new viruses from such constructions. Certainly the widely used cauliflower mosaic virus is a potentially dangerous gene. It is a pararetrovirus meaning that it multiplies by making DNA from RNA messages. It is very similar to the Hepatitis B virus and related to HIV. Cauliflower mosaic virus may recombine with related Hepatitis B or for that matter HIV to create a most powerful disease. The salient feature being large numbers of people or animals consuming large numbers of viral genes incorporated into crop plants making up a major part of human and animal diet. Thus modified viruses could cause famine by destroying crops or cause human and animal diseases of tremendous power.'*

REFER TO APPENDIX ONE – RISKS DIAGRAM

5.0 Genetically engineered products carry more risks than traditional foods

Principles of medical risk assessment have been incorrectly applied to risk assessment of novel foods. This has introduced unnecessary risks into foods.

5.1 The process of genetic engineering can introduce dangerous new allergens and fatal toxins or diseases into foods that were previously naturally safe. For example, one genetically engineered soybean was found to cause severe allergic reactions and the flavr-savr tomato was found to cause stomach and intestinal lesions in rats. In addition, modified plants containing antisense genes that switch off specific genetic functions, such as a ripening gene in a tomato, pose the possibility that critical functions including gene replication, sperm activity, and gene imprinting could be disrupted. Genetic recombination of viral vectors and promoters with other viruses, E-coli, Shigella, or Salmonella is already suspected as the cause of deadly new intestinal illnesses that have selective advantages.

5.2 These are technical issues, but they are widely discussed in the scientific literature. These new pathways for disease creation are currently being investigated through laboratory experimentation. **Therefore it is folly to allow such hazards into the food chain. The potential for disease creation is too great, while the potential benefits for consumers are almost non-existent.**

5.3 Moreover, the application of principles of medical risk assessment, as some have suggested, is inappropriate for safety assessment of novel foods. In medical risk assessment, the risks of new medicines are assessed with reference to the average life expectancy of patients suffering from a particular condition. Some risks are permitted in the hope that life expectancy and quality of life can be improved for the majority. In the case of foods this is not appropriate, consumers are not suffering from an illness that genetically engineered foods will alleviate. When assessing food safety, it is not appropriate to approve foods that introduce <u>any</u> new risks.

5.4 Informed comment:

'Most biotechnology companies use micro-organisms rather than food plants as gene donors, even though the allergenic potential of these newly introduced microbial proteins is uncertain, unpredictable, and untestable' Allergies to transgenic foods, Nestle, New England Journal of Medicine 334:726-728, 1996.

Scientific references:

Enhanced accumulation of toxic compounds in yeast cells having high glycolytic activity: a case study on the safety of genetically engineered yeast. Inose, T. and Kousaku, M. International Journal of Food Science Technology, 30, 141-146, 1995.

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Boyer, J. and Haenni, A., Virology 198:415, 1994.

Desuns, J. and Lomonossoff, G. J. Gen. Vir. 74:889, 1993.

6.0 Traditional medicine and genetic engineering

Genetic engineering will interfere with the healing potential of plants as understood by traditional natural systems of medicine.

6.1 There is a rich world heritage of traditional medicine which relies on the medicinal properties and herbs and plants. For example, Maharishi's Vedic Approach to Health[1] utilises fundamental principles of Ayur Veda, the oldest known traditional medical system, in which there exist materia medica detailing the specific medicinal effects of more than 6,000 plants. The effectiveness of Maharishi's Vedic Approach to Health in curing chronic illness is well documented and points to specific properties of plant genetic structures that can stimulate specific immune functions of the individual. Similarly, indigenous peoples in New Zealand, Australia, the Pacific Islands, and most other countries have a rich knowledge of the healing effects of plants.

6.2 Such traditions hold that it is the 'intelligence' in plants that succeeds in curing an individual. Until recently this concept was not understood by western science. With advances in the understanding of genetic structure, it is now clear that the sequence of genetic information and regulation equates with the concept of 'plant intelligence' that is treasured by ancient traditions of indigenous peoples. This is starting to change the way that we look at nutrition.

6.3 Previously nutrition was thought to rely on a combination of vitamins, minerals, trace elements, fats, proteins, carbohydrates, and co-factors of digestion. Even four years ago, New Zealand genetic scientists asserted that genetic engineering was safe because they believed human digestion broke down all viable genetic material in foods into a combination of the above factors. Now recent research results have changed this idea and started to validate the more traditional concept of ‘intelligence’ or orderly structures of foods.

6.4 Researchers in Germany have found that long sequences of genetic information pass from the digestive tract of animals into their blood cells and other tissues. They believe that such sequences may play an important role in nutrition and health which is not yet understood. This is the subject of an intensive research effort.

6.5 Normally cells are programmed to expel viral sequences within 18 hours, but genetic engineering attaches toxic viral and bacterial sequences to genetic food sequences which the body recognises and utilises. Therefore genetic engineering of foods could open up pathways for toxic sequences of genetic information to avoid immune responses and cell purification mechanisms by participating in nutritional absorption processes whereby they could seriously disrupt human physiological functioning.

[1] Reference here to Maharishi’s Vedic Approach to Health is offered to provide the Royal Commission with an example of traditional medicine. It does not reflect the views or opinions of all members of GE Free NZ, rather is provided towards a GE Free NZ which all of our members support.

6.6 This is already happening in the insect kingdom. It has been found that bacillus thuringiensis (Bt), a naturally occurring pesticide used safely by organic farmers, became far more potent when it was genetically engineered into maize and other plants. Incorporated as a part of food DNA, it becomes capable of killing beneficial insects and predators such as lacewings, ladybirds, monarchs, and bees. In Switzerland, lacewing populations fell by 50% when they ate insects that had fed off the genetically engineered Bt maize.

6.7 In Scotland, it was found that lifespan and fertility of ladybirds fell by 50% when they ate aphids who fed on Bt potatoes. In Thailand, bee populations were reduced by 40% in greenhouses containing Bt crops. This shows that poisonous genetic sequences introduced into food DNA can persist in the food chain.

6.8 This means that safety assessments of genetic engineering of foods need to be revised. For example, disrupting the genetic sequence of plants could degrade the capacity of plants and herbs to both nourish an individual and cure illness. It could interfere with the healing properties of plants that are the heritage of indigenous peoples and with current research efforts to revive traditional medicine for the benefit of humankind.

Scientific references:

Risk assessment and scientific knowledge. Current data relating to the survival of GMOs and the persistence of their nucleic acids: Is a new debate on safeguards in genetic engineering required? JŠger, M.J. and Tappeser, B. Presented to the TWN Workshop on Biosafety, New York, April 10, 1995.

Ingested foreign (phage M13) DNA survives transiently in the gastrointestinal tract and enters the bloodstream of mice. Schubbert, R., Lettman, C. and Doerfler, W. Mol. Gen. Genet. 242, 495-504, 1994.)

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Lacewings affected by Bt crops in Science Briefing, London Times, 4 May 1998

Ladybirds affected by Bt crops, Hawkes, N., London Times, 22 October 1997

7.0 Assessment of the extent of health hazards from genetic technology

Similar mistakes are being made with the regulation of GE foods as were made with the regulation of BSE risks in Britain.

7.1 Despite the foregoing, some biotechnology companies are pretending that there will be no risk to health. Their standard defence to the preceding discussion of health hazards is that risks are small and that minute changes to dietary intake will have little impact on health. This is clearly not the case. It is unscientific and unfounded to suggest that risks from genetically engineered food are insignificant. There are already many examples of serious side effects, even though very few genetically engineered foods, additives, and medicines have been introduced so far.

7.2 To suggest that there will be no further significant health hazards from future genetically engineered foods is patently absurd. Individuals holding to this

view are either misinformed or simply blinkered by the lure of biotechnology promises and research funding.

7.3 A recent revelations about the high failure rates, mutations, and disease generation involved in animal genetic experiments, the results of early experiments in by NIH in the US demonstrating the viability of disease creation in genetic labs, the concerns of UK medical experts concerning the impact of gene foods on our capacity to cure problem diseases such as VD and TB, and the well-documented failures of experimental gene therapy underline these concerns very heavily.

References:

Diaries of Despair: The Secret History of Pig-to-Primate Organ Transplant Experiments, at www.xenodiaries.org.

Archives of the UK Advisory Committee on Novel Foods and Processes (ACNFP) February 1999

Archives of MIT 1976 to 1979, summarised in Gene Watch, the bulletin of the Council for Responsible Genetics by Susan Wright, a Science Historian at the University of Michigan. Also at Tidepool website.

Report Warns on Human Gene Trials. September 19, 2000 By Paul Recer. AP Science Writer. WASHINGTON (AP) via NewsEdge Corporation –

7.4 Similar mistakes were made in Britain when assessing risks associated with BSE - mad cow disease. Repeatedly over an eight year period, politicians, Government officials, and Ministry of Agriculture scientists gave assurances that BSE could not be passed on to humans. The mistake was that 'no evidence of risk' was equated with 'no risk'. In fact no long term studies on health and safety had been done, and therefore nothing certain was really known. It took years for the appearance of a new strain of CJD to be identified as the human form of BSE. Meanwhile hundreds of millions of Europeans had been exposed unnecessarily to serious risks.

7.5 Some estimates now suggest that incidence of CJD will reach epidemic proportions in Britain and the EU by the year 2015. The parallels with genetic engineering of food are striking. Governments took the advice of individuals who were committed to the biotechnology paradigm. They hoped that it will be safe, but no long term studies had been done. Instead the 'precautionary principle' should be applied. Rather than saying 'No one has proved that it is unsafe', the burden of proof should be on the manufacturers to prove that it is safe. In any case, there is already enough accumulating evidence to give good grounds to know that GE foods are very unsafe.

7.6 Genetically engineered substances have already caused cancers and illness in test animals.

7.7 We have already referenced many of the unanticipated side effects, but it is worth noting two more. Bovine growth hormone (rBGH) made by Monsanto in the USA and a human insulin substitute developed by Novo Nordisk in Denmark are both examples of products designed to be almost identical to biochemicals which occur naturally in cows and humans.

7.8 Both products have caused substantial side effects in test animals. Under the American Freedom of Information Act, Monsanto Corporation released the following details of side effects: rBGH has resulted in reduced pregnancy rates, an increase in cystic ovaries and uterine disorders, decreases in gestation lengths and calf birth weights, increased twinning rates, increased retained placentas, increased clinical and sub clinical mastitis, increased bloat, indigestion and diarrhoea, increased numbers of enlarged hocks and knee lesions, anaemia, and visible reactions of up to 10cms at the injection site. Subsequent research has found decreased longevity of cows, increased levels of antibiotics in milk, and elevated levels of IGF-1 in milk which is a known risk factor for both breast and gastrointestinal cancers.

Scientific references:

Unlabelled milk from cows treated with biosynthetic growth hormones: a case of regulatory abdication. Epstein, S.S., International Journal of Health Services, 26(1), 173-186, 1996.

Recombinant bovine growth hormone: Alarming tests, unfounded approval. The story behind the rush to bring rBGH to market. Christiansen, A., Rural Vermont Report, October 1995.

Down on the farm: The real rBGH story: Animal health problems, financial troubles. Kastel, M.A. Rural Vermont Report, October 1995.

7.9 In a parallel example, development of Novo Nordisk's engineered or enhanced insulin substitute was abandoned after test animals developed cancerous tumours. Novo Nordisk's original genetic insulin product, which is a copy of human insulin is according to the manufacturer 'synthesized in a non-disease-producing special laboratory strain of **Escherichia coli [E.coli]** bacteria that has been genetically altered by the addition of the human gene for insulin production.' This has also caused health problems for some users.

7.10 This has given rise to a class action in the US courts. Given that GE drugs have to go through tougher testing procedures than GE foods there will be considerable concern that amongst other things one or both of the two defendant biotechnology companies stand accused in this 'class action' of having:

7.10.1 failed to conduct appropriate and adequate clinical trials **'such that the long-term effects of these drugs are not known nor documented'.**

7.10.2 **'paid for, arranged for and caused rapid approval'** from the Federal Drug Administration **'despite having knowledge of the potential life-threatening side effects from these drugs and despite that the long-term effects of these drugs have not been determined'.**

7.10.3 given rise through such products to personal injuries including **'disfigurement, loss of consortium and death'.**

7.10.4 failing to provide adequate warnings to doctors that **'such products could result in antibody production, arthritic syndromes and other potentially injurious, life-threatening symptoms in diabetic patients.'**

7.10.5 **'intentionally, recklessly and maliciously suppressed information which would inform the diabetic public as to potential injurious side effects'.**

7.10.6 'intentionally, recklessly and maliciously failed to provide other, less risky alternatives for treatment in full knowledge of the potentially injurious, life-threatening side effects to diabetics'.

7.11 It has taken nearly 20 years for this situation to come to full public attention. Meanwhile the less rigorously tested GE foods are being given to entire populations especially in the US.

7.12 The allegations of adverse effects from GE insulin are arising despite the fact that at least one of these products (according to its manufacturers) is: "**structurally identical** to the insulin produced by your body's pancreas". By contrast genetically 'modified' or 'engineered' foods do not have to be **'structurally identical'** to their natural counterparts but only **'substantially equivalent'**. It is also of interest that GE insulin is frequently cited in biotechnology promotional literature as an example of how genetic engineering can benefit health.

References:

http://members.tripod.com/diabetics_world/Diabetics_World_Insulin_Structure.htm

http://members.tripod.com/diabetics_world/Class_Action_suit.htm0

ALBUQUERQUE Journal, New Mexico SATURDAY. APRIL 8, 2000 **N.M. Diabetic Sues Over Insulin**

7.13 From this, it is quite clear that long term risks to health need to be taken very seriously. **Therefore it seems essential that long term testing of genetically engineered foods on human health be undertaken, however no viable protocol for such testing is available. Therefore genetic technology should be banned.**

7.14 Diet and disease

Novel proteins generated by genetically engineered foods could cause serious illness associated with long incubation periods. They could also interfere with research aimed at identifying dietary causes of established illnesses.

7.15 Food and diet plays an important role in the genesis of disease. Now that modern genetic diagnostic techniques are available, this role is only just beginning to be understood. Many degenerative illnesses have a high incidence in developed countries where the population has significant dietary intakes of processed foods and additives. Conversely diseases such as cancer, MS, and Parkinson's disease have a very low incidence in some developing countries where staple diets are still largely natural. These differences are not fully understood, nor are recent surges in volumes of acute illness in many countries including New Zealand. Diet is a prime suspect in the scientific effort to identify causal factors.

7.16 Informed comment:

Professor Bob Elliott, leading researcher on diabetes at the Auckland Medical School and Child Health Research Foundation, has pointed out that the consequences of genetic engineering of foods, medicines, and animals are totally unpredictable and constitute a grave health hazard for mankind. He asserts for example that no one could possibly have predicted the carcinogenic

effect of genetically engineered insulin and believes that molecular biologists are altering the genetic structure of foods without due regard for safety, since they have an unpredictable effect when introduced into diet.

7.17 Professor Elliot has been investigating a link between diabetes and levels of beta casein A1 milk protein produced by Fresian cows. He has found that A1 protein is a contributing trigger in cases where type one diabetes-susceptible individuals develop the illness. It took fifteen years of painstaking work to establish this connection. The prevalence of A1 protein in milk was exacerbated by selective breeding of Fresian cows for high protein milk content combined with a world wide artificial insemination programme. As a result many more individuals around the world including young children not previously at risk now suffer from diabetes. He also found that some traditional breeds of cows, such as Brahman cows, were clear of the A1 protein leaving local populations of some countries virtually free of type one diabetes.

Scientific reference:

Proceedings of the second international conference on polymorphism in milk, Elliott, B. and Hill, J., New Zealand Dairy Research Institute, February 27, 1997.

7.18.1 Genetic engineering introduces far greater dangers than selective breeding because exotic proteins are introduced that have never previously been in foods. As it took Professor Elliott fifteen years to trace the specific protein implicated in increased incidence of diabetes in children, how can it possibly be safe to introduce genetically engineered foods without long term testing?

7.18.2 **Therefore, the introduction of thousands of unlabelled genetically engineered foods each containing novel proteins, will not only cause new illnesses, but also disrupt existing scientific research efforts to identify causal factors for serious illness coming from pre-existing foods and additives in diet.**

7.18.3 As a parallel comment, is also relevant to mention here the on-going discussion in the literature of the possible health effects of the artificial sweetener aspartame which is produced using genetic technology. Concerns which have been raised include the possibility of links to high incidence of childhood leukaemia, neurological disease, brain tumours, Parkinsonism, and Althzeimers disease. The needed long term research on health and safety was not done before the product was released. In this case, commercial pressures to bring the product to market took precedence over health concerns. The complexity of the research issues are such that no one knows for sure if aspartame is a causative factor for example in the 8000% increase in incidence of childhood leukaemia that has occurred over the last two decades. Meanwhile almost half of all Americans are regularly consuming aspartame as an ingredient in confectionery.

8.0 Pesticide and herbicide residues, health, and food shortages

There is little or no evidence that biotechnology will help feed the growing world's population, but there is evidence that it may cause crop failures, loss of biodiversity, health problems, and food shortages. Organic farming and

preservation of local biodiversity are seen as proven solutions to these problems.

8.1 Biotechnology advocates suggest that genetic engineering of foods will help to feed a growing world population and reduce dependence on chemicals in farming. This consideration forms a background to government level decisions as to whether to approve genetically engineered foods. No responsible person wants to hold up beneficial technological progress, therefore promises of increased food production might lead some regulators to ignore health hazards in favour of the promise of progress in achieving health targets and social goals. The mission to feed the world has an almost irresistible ring of noble endeavour, but is it the case? No studies to date have demonstrated consistent increased yields from biotechnology crops. In fact, the reverse appears to be the norm - reduced yields and unexpected mutagenic events.

8.2 Biological diversity and health and food security are intimately linked. Recent studies show that diverse ecological communities are more resilient to drought and other ecological disturbances. Local varieties grown through mixed cropping and temporal rotation naturally maintain soil fertility and prevent outbreaks of pests and disease. The diversity of agricultural produce is also the basis of balanced nutrition, because only a varied diet can provide necessary trace elements, vitamins, fats, carbohydrates, co-factors, etc. to maintain health.

8.3 A major cause of malnutrition world wide is the substitution of the traditionally varied diet of indigenous peoples for one based on monoculture of crops. The transfer of exotic genes into monoculture crops through biotechnology will do nothing to make up the dietary deficiency of those suffering from monoculture malnutrition. The real threat to healthy world food supplies comes from loss of biological diversity. The best way to combat loss of biodiversity and local food shortages created by decades of intensive monoculture farming, is to encourage organic farming methods that revive traditional practices. Such programmes have been successful in increasing output in affected third world nations by 300-400% within one year. Conversely, genetic engineering of crops to resist herbicides will mean further loss of diversity, because increased use of powerful wide spectrum herbicides will indiscriminately eliminate indigenous species and local cultivated varieties.

8.4 GE Free New Zealand and the Natural Food Commission advocates sustainable development based on agricultural practices that nourish the seed, the soil, the weather, and the farmer. Maharishi's Vedic Agriculture[2] has revived the most ancient practices of farming which in addition to nourishing the plant create Vedic Consciousness in the farmer. Much research has demonstrated how intimately plants respond to the feelings of people around them. Studies of the use of Vedic sounds, show a consistent pattern increased root growth. The Vedic Consciousness of the farmer will create a beneficial response in every plant in the field, and this will implant a real nourishing value in the crops. We have to stop poisoning the farmer and the soil with

[2] This reference does not necessarily reflect nor is it supported by all members of GE Free NZ. It is included to give another perspective on different methods of sustainable agriculture and in the interests of a GE Free NZ which all members support.

modern pesticides, and herbicides and revive the ancient practices that will ensure that natural law is lively in agriculture and nature is balanced. So that the seasons come on time with timely rains, timely wind, and timely sunshine.

8.5 **There are many avenues for research into sustainable development which should be funded by government as an alternative to funding research into biotechnology in agriculture.**

Scientific references:

Balance of Nature - Ecological issues in the conservation of species and communities, Pimm, S.L., The University of Chicago Press, 1991.

Traditional farming in Latin America, Altieri, M.A., The Ecologist, 21, 93-96, 1991.

Biodiversity is a boon to ecosystems, not species, Moffat, A.S., Science 271, 1497, 1996

Perils amid promises of genetically engineered foods, Ho, Mae Wan, Biology Dept., Open University, UK, 1997.

Celebrating perfection in education, Maharishi Mahesh Yogi, Maharishi Vedic University Press, 1997.

8.6.1 GE crops already commercialised have been associated with increased use of herbicides rather than less as promised by biotechnology advocates. Crops that produce their own pesticides are seen as posing an additional health risk. They should be banned immediately.

8.6.2 It has been estimated that more than 57% of biotechnology research on foods is to make plants resistant to herbicides and pests. Initially biotechnology companies promised that consumers would benefit overall from reduced use of herbicides and pesticides. However, first hand experience suggests the opposite. Monsanto Corporation in the USA has engineered a soybean by inserting DNA from soil bacteria and a plant virus into its genetic structure to make the plant resistant to Monsanto's best selling brand of herbicide Roundup.

8.6.3 This means that the soybean plant can stand repeated dousing with Roundup, while weeds are killed off. Robert Shapiro, Monsanto chief executive, is reported in the 24 October 1996 New York Times as betting on Roundup sales to boost company profits to record levels. 'I keep writing cheques for big bucks' to expand Roundup manufacturing capacity 'as fast as we know how,' says Shapiro. Consumer representatives are less than happy. They point out that the genetically engineered soybeans carry no nutritional benefits for consumers, moreover increased use of herbicides may cause more illness.

8.6.4 Simultaneously Monsanto has applied to ANZFA for a two hundred fold increase in residues of Roundup to be permitted in foods. The proposed increase is from 0.1mg/Kg to 20mg/Kg. This is a substantial increase which will bring the level of glyphosate in human diet not far below the recommended daily requirement for some vitamins and trace elements.

8.6.5 Glyphosate, the active ingredient in Roundup, is currently being assessed for its impact on reproduction mechanisms in rodents and therefore the increased levels of glyphosate in food could be harmful to human health. More

importantly a study by eminent oncologists Dr. Lennart Hardell and Dr. Mikael Eriksson of Sweden has revealed links between Glyphosate use and non-Hodgkin's lymphoma, a form of cancer that afflicts the lymphatic system whose incidence has increased by 80% since the early 1970Õs. In the study published in the Journal of the American Cancer Society, the researchers maintain that exposure to glyphosate 'yielded increased risks for NHL.'and recommend that 'glyphosate deserves further epidemiologic studies.' The findings are based on a population-based case-control study conducted in Sweden between 1987 - 1990. The necessary data was ascertained by a series of comprehensive questionnaires and follow-up telephone interviews. Dr. Hardell and Dr. Eriksson found that 'exposure to herbicides and fungicides resulted in significantly increased risks for NHL'.

Scientific references:

National Toxicology Program technical report on toxicity studies of glyphosate administered in dosed feed to F344/N rats and B6C3F1 mice. National Institute of Health, 92-3135, July 1992

Toxic effects of carbofuran and glyphosate on semen characteristics in rabbits, Yousef et al., Journal of Environmental Science and Health, B30(4), 513-534, 1995.

A sensitive sperm-motility test for the assessment of cytotoxic effects of pesticides, Yousef et al., Journal of Environmental Science and Health, B31(1), 99-115, 1996.

Glyphosate. Part 1: Toxicology. Part 2: Human Exposure and Ecological Effects, Journal of Pesticide Reform, Vol. 15, Numbers 3 & 4, Fall & Winter 1995.

Acute poisoning with a glyphosate-surfactant herbicide ('Roundup'): a review of 93 cases. Talbot AR; Shiaw MH; Huang JS; Yang SF; Goo TS; Wang SH; Chen CL; Sanford TR, Department of Critical Care Medicine, Changhua Christian Hospital, Taiwan, Republic of China.

Lennart Hardell, M.D., PhD. Department of Oncology, Orebro Medical Centre, Orebro, Sweden and Miikael Eriksson, M.D., PhD, Department of Oncology, University Hospital, Lund, Sweden, 'A Case-Control Study of Non-Hodgkin Lymphoma and Exposure to Pesticides', Cancer, March 15, 1999/ Volume 85/ Number 6.

8.7 Pesticide-producing genes in food

8.8 Crops containing pesticides built into their genetic structure could be more hazardous than pesticides on their own. Poison producing genetic sequences could 'escape' to other crops and poison our food supply.

8.9.1 Many genetic engineering projects have focused on the introduction of Bt genes in plants. Bt genes produce a pesticide which has been used in organic farming for some years. No adverse reactions to previous topical uses by organic gardeners have been reported, so genetic engineers are predicting that Bt producing plants will be safe for human consumption.

8.9.2 As we have already discussed, Bt plants are proving poisonous to beneficial insects that were previously unharmed by Bt sprays. Now, fears are being

expressed that Bt genes in plants will expose humans to higher concentrations of Bt and more frequently than before. This may generate health hazards including allergic reactions or other more serious illness.

8.9.3 Recent experience in New Zealand upholds this fear. In 1996, the exotic white-spotted tussock moth was found in Auckland. This moth had been imported inadvertently and became established in one suburb. The white-spotted tussock moth poses a danger to New Zealand forests. A programme of regular aerial and ground spraying with Btk was initiated in the suburb amid assurances that Btk was completely safe. After six months of this repeated exposure to Btk, nearly one hundred local residents gathered at a public meeting to demand that the aerial spraying cease immediately. Residents reported a variety of allergic reactions including headaches, nausea, skin rashes, itching, breathing difficulties, and burning soreness of the throat and lungs. (See:The New Zealand Herald, Friday April 4th 1997)

8.9.4 GE Free New Zealand believes that it is unwise to introduce pesticide genes into plants. Such genes will be almost impossible to eradicate once they are introduced. More than 20 years after DDT was banned, New Zealand is still trying to clean up DDT residues. NZ food manufacturers still find it necessary to test for DDT in wheat, other crops, and animal products. Mistakes with genetic foods are inevitable, but genetic pollutants can reproduce themselves and therefore, unlike DDT, they will be impossible to eradicate.

8.9.5 We have had experience already with the introduction of exotic species to New Zealand such as rabbits and gorse, which have proved to be a real headache for farmers. In another example, pit bull terriers have been imported recently. Now, as in Britain and elsewhere, the breed is causing problems and the first attacks on humans have been recorded. The public has called for the breed to be eradicated, but of course this is not possible as inter-breeding has already occurred. The New Zealand economy relies on agriculture. Any genetic pollution of crops or animals in New Zealand could have serious economic implications for us. It could cause crop failures, virulent pests, ecological instability, overseas boycotts of our goods, or the introduction of new toxins in crops.

8.9.6 More than anything else, the New Zealand Government has a duty to protect the public from novel health hazards. In the case of genetically altered foods, these risks are sufficiently serious to warrant a moratorium on their introduction. Plants have been genetically engineered to produce their own pesticides carry genes that pose a special category of health risk. Such plant structures have been programmed to continuously produce chemicals that are poisonous to living organisms, including humans. The long term health effects of consuming such foods could be serious and are very difficult to assess.

8.9.7 It is not enough to argue that the enzymatic action of such foods will be destroyed when they are cooked. Everyone knows that all foods are eaten raw by some people and by animals. Foods are also often undercooked. It is irresponsible to approve such foods under the present inadequate regulations which are suited to testing for hygiene, but not for novel effects of genetically engineered foods. **Therefore there should be a ban on the release of all foods which confer resistance to pests.**

9.0 Toxicology and safety testing

9.1 Tests for known toxins and animal toxicity tests have proven inadequate to identify potential harmful side effects of GE foods. To protect public health, full spectrum toxicity testing should have been required as with pharmaceuticals.

9.2 Hazards can also arise because of toxic byproducts of novel enzymatic function. Toxicological assessment techniques used by food manufacturers are inadequate to detect all of these hazards. Current tests include 90 day toxicity tests using rodents. This form of testing is inadequate to assess the effect of novel foods on human health.

9.3 Informed comment:

Professor Dennis Parke of University of Surrey School of Biological Sciences, a former chief advisor on food safety to Unilever Corporation and British advisor to the US FDA on safety aspects of Biotechnology writes: *'In 1983, hundreds of people in Spain died after consuming adulterated rapeseed oil. This adulterated rapeseed oil was not toxic to rats'.* Dr Parke warns that current testing procedures of genetically altered foods are not proving safety for humans. He has suggested a moratorium on the release of germ line genetically engineered organisms.

9.4 Additionally current testing regimes including those relied on by ANZFA and ERMA look for specific known toxins. Completely new toxins, allergens, and carcinogens, not previously encountered, are likely to be produced by novel foods, so testing for known toxins, etc will not be adequate to detect all possible harmful side effects. For example L-tryptophan, a genetically engineered food supplement, was found to contain more than sixty contaminants after it unexpectedly caused human fatalities. **Therefore full spectrum testing for toxicity followed by long term human trials should have been required for genetic foods.**

9.5 Informed comment:

Dr Michael Antoniou leads a gene technology research group at one of London's main teaching hospitals, he comments on novel food safety: *'Unfortunately, there is no requirement for general toxicity testing akin to that used for pharmaceuticals. This may lead to unexpected, unknown toxins or novel allergens only being discovered if a health problem arises.'*

9.6 ANZFA regulations exempt derivatives of food processing including those produced by milling, pressing, squeezing, refining, etc from labelling requirements. Such processing of food is no guarantee of safety as previous experience already demonstrates. Traces of genetically engineered material are detectable in such products and are capable of causing unforeseen health hazards. **Therefore derivatives of genetically altered organisms or genetic engineering processes should not be exempt from regulation.**

9.7 Informed comment:

Dr Michael Antoniou continues: *'Furthermore, food processing which either destroys or removes the genetic material and its protein product is assumed as being safe. Nevertheless, toxins and allergens may still be present in the final product. Interestingly, the tryptophan disaster, in which 37 died and 1500*

people were permanently disabled after consuming a food supplement produced using genetic technology, would have occurred even under the current proposals due to the fact that it was caused by an unexpected, new toxic contaminant present in the final, presumed pure product devoid of DNA and proteinaceous material.'

9.8 ANZFA regulations do not contain provisions for independent testing of the safety of novel foods. ANZFA relies on the assessments and submissions provided by the manufacturers and regulators in the country of origin of the novel foods. This process is open to abuse. It is a highly risky method of assessing safety as the manufacturers have commercial reasons for hurrying their products to market and may cut corners with safety testing and assessment. It has been suggested that this has happened already with biotechnology products such as rBGH. **Therefore demonstrably independent testing procedures should have been a required element of approval processes.**

Scientific references:

Unlabelled milk from cows treated with biosynthetic growth hormones: a case of regulatory abdication. Epstein, S.S., International Journal of Health Services, 26(1), 173-186, 1996.

Plagiarism or protecting public health? Millstone, E., Brunner, E., and White, I. Nature, 371 647-648, 1994.

Conflict of interest alleged in BGH approval. Puzo, D.P. The Los Angeles Times, April 21, 1994.

Sidelined by side effects. Green, D. Financial Times, February 23, 1995.

Potential public health impacts of the use of recombinant bovine somatotropin in dairy production. Hansen, M., Halloran, J.M., Groth III, E., and Lefferts, L. Consumers International submission prepared for the Joint Expert Committee on Food Additives, USA. September 1997.

9.9 The fundamental principles of toxicology have developed little since their invention hundreds of years ago. Under traditional toxicological principles, even very toxic chemicals are assumed to be safe when they are consumed in minute doses. A fundamental mistake of toxicology in the twentieth century has been to assume that when the effect of a chemical cannot be measured by current techniques, then the chemical will be safe when consumed in even lower doses. Under this principle, we have seen the emergence of high incidence of cancers throughout industrialised countries who have high environmental pollution and high usage of processed foods, pesticides, and additives.

9.10 Modern research shows that certain chemicals are more poisonous when consumed in very low doses than medium doses. This is because very low doses are insufficient to activate protective immune system responses. The knowledge we have now of human sensitivity to minute quantities of chemicals should lead to a revision of the practice of modern toxicology. Unusual genetic sequences placed in foods by genetic engineering will cause wide spread sensitivity to staple foods. Moreover, individuals who already have sensitive immune systems such as those with multiple chemical

sensitivity (MCS) will be put at greatly increased risk when unusual genetic sequences are incorporated into foods.

10.0 Genetic engineering and consciousness

10.1 Complex functions of the DNA that relate to sentient functions of the human physiology are little understood at present. Genetic engineering has the capacity to disable sensory and consciousness mechanisms seated in the physiology.

10.2 A gene is a sequence of codons within the DNA that produces a protein or enzyme that has a particular function in the physiology of a plant, human, or other organism. There are tens if not hundreds of thousands of genes in any given organism. Genetic engineering is the process of transferring genes between species. The aim of this process is to transfer desirable traits from one organism to another. For example a gene from an Arctic fish has been transferred to a tomato to try to make it more frost resistant. In Australia, a part of a human gene has been put in a pig to make the it grow larger with more lean meat. In practice there are side effects, the pigs end up with arthritis and tomato crops have failed to perform.

10.3 Side effects arise because genes function in a coordinated manner with other genes. The popular press promotes a picture of genes as separate entities in a chain each performing an individual task. This picture is misleading. In actuality, there are 'families' of genes that work together. Families in turn work in a coordinated manner within the whole genome involving hundreds of thousands of genes. Other cellular components also play a role in controlling the expression of genes. A gene that expressed a particular protein, at just the right time in just the right the place in just the right quantity in one organism will perform differently when transferred to another organism. It may perform completely differently and this can cause damage.

10.4 Moreover genetic engineering involves a random and forceful integration of genes into the target organism. In many cases genes are fired into the target cells using a gene gun which fires metal pellets smeared with genetic material. The genes end up in a random placement in the target DNA and this causes random faults in the functioning of the DNA. Even when the technology becomes available to place genes exactly, so little is known about how genes function that side effects will still be inevitable.

10.5 Because genetic engineering is a random process of forcibly integrating new sequences of genetic information from unrelated species into the DNA of the target organism, the natural functioning and balance of the DNA is upset. This threatens the stability of the organism. This indicates that research and applications of genetic engineering may have the potential to disable some very fundamental properties and functions of any organism.

10.6 These could include the balanced expression of consciousness itself. Research on Maharishi Mahesh Yogi's Transcendental Meditation[3] has shown that integrated functioning of the brain is connected with long range coherence

[3] Reference to Transcendental Meditation is included for the purpose of providing the Royal Commission with a wide perspective on issues concerning genetic engineering in food and the environment. It does not reflect nor is it supported by all members of GE Free NZ but rather provides another perspective towards a GE Free NZ which all of our members support.

among neurons as indicated by spectral analysis of EEG patterns. High levels of long range EEG coherence generated by Transcendental Meditation in the brain have been correlated with improved neurological efficiency, increased creativity, IQ, concept learning, academic performance, and moral reasoning, clarity of conscious awareness and reduced neuroticism.

10.7 Other studies have found very long range field effects of consciousness. Groups of people practicing Transcendental Meditation can produce improvements in social phenomenon such as reduced crime, accidents, and suicide rates in surrounding populations. Serotonin levels and EEG patterns in nearby individuals have been shown to be influenced beneficially. These research studies indicate that consciousness is intimately related to physiological functioning. Physiological functioning in turn depends on the integrity and orderly expression of the information contained in the DNA.

Scientific references:

International Journal of Neuroscience 13 (1981):211-217.

International Journal of Neuroscience 15 (1981):151-157.

International Journal of Neuroscience 49 (1989):203-211.

Psychology, Crime and Law 2(3) (1996):165-174.

Journal of Mind and Behavior 9 (1988):457-486.

Neuroscience Abstracts 14 (1988):372.

11.0 Risks of horizontal gene transfer

11.1 Due to the present ignorance of the total functioning of the physiology and its basis in the DNA, many sections of DNA information have been dismissed by some geneticists, who are unfamiliar with fundamental physical principles, as 'silent' or 'inactive'. However nature is well known to be parsimonious - for example, it follows the physical principle of 'least action' at every level of its organisation. All laws of nature uncovered by modern physics can be mathematically formulated as 'least action' principles. In future, bio-physicists expect to uncover subatomic processes and functions at the field level of DNA and in the so called 'inactive' sequences which play a crucial role in evolution and maintenance of the organism.

11.2 Although biotechnologists can design precise genetic sequences in the test tube. We have seen that the actual location of a new sequence in the genome of the host organism is always a random mutative event and which causes random changes in the host organism's functions. Therefore genetic engineering not only disrupts the actual sequence of active genes which is known to be very important, but it also affects the silent sequences of DNA, and the crucial self-interacting properties of the whole DNA molecule which may be connected to the field functions of consciousness as well as to perceptual processes. For example recent reports suggest that sensory mechanisms of bees can be disabled by gene-altered crops.

Scientific reference:

Sting in the tail for bees. Crabb, C. New Scientist, 16 August 1997.

11.3 Nature is an interacting holistic system. All organisms share a common DNA base. However, transferring genetic information specific to one class of organisms into the DNA of another unrelated species through genetic engineering opens up new pathways for unfavourable genetic mutation. Transfer of genetic information between unrelated species is known as horizontal gene transfer. Such horizontal gene transfer events certainly happen in nature, but they happen rarely and natural control mechanisms tend to rule out unusual events.

11.4 Genetic engineering is truly mutagenic, it lacks the natural control mechanisms which tend to ensure that only genes with similar structures can exchange places. Through horizontal gene transfer, mutations in food DNA caused by genetic engineering can conceivably and ultimately change DNA structures and functions in higher organisms. When millions of individuals or animals are exposed to unusual genetic structures in their daily diet, as is happening with the genetic engineering of crops, the risk of mutation is magnified.

11.5 Similarly, through horizontal gene transfer, many unusual and deadly experimental genes can easily escape and affect other species. These include cancer producing genes that have been incorporated into the genome of mice at Harvard University, plant infertility genes that have been engineered by the USDA, and mechanisms to disable the immune system of plants that have been engineered by Norvartis. Deadly genes are also being produced in biological weapon and defence programmes around the world.

12.0 Conclusion

All this implies unequivocally that genetic engineering is a very risky technology. The old adage 'a little knowledge is a dangerous thing' applies par excellence. Moreover, there can be no justification for introducing novel genes and therefore serious health risks into foods that were previously naturally safe. Nor are there any proven nutritional advantages of gene-altered foods for consumers. Genetic engineering of food is a bridge too far. A serious risk to the basis of the whole field of human evolution and happiness that has no saving grace. **Only an immediate ban on the introduction and sale of genetically engineered food and on genetic engineering will be able to protect the public from serious health hazards and wide spread crop failures.**

Section B (j) (ii)

1.0 Differentiation Between 'Contained Use' and 'Releases' into the Environment

In this section which highlights potential risks to the environment, it is appropriate to state that when considering these risks we differentiate between 'contained use' and 'releases' into the environment.

1.1 We agree with Dr Maewan Ho's statement: *"Contained use occurs inside a physical facility designed to prevent escape into the open environment. It can be controlled, in principle, and made as safe as possible (though the current regulation of contained use is far from adequate). Release of transgenic*

organisms to the environment, by contrast, cannot be controlled or recalled, which is why great care must be taken in advance of release." (Mae Wan Ho, 1999)

1.2 We also acknowledge that while 'contained use' escapes are possible, this section specifically addresses the risks to the environment when genetically engineered organisms are released into the environment, with or without control conditions.

2.0 Genetically Engineered Crops, Plants and Animals Are Different from Conventional Breeding

2.1 The risks of genetically engineered organisms to the environment are at present largely unknown and uncalculated. This is because the full extent of genetic engineering technology in agriculture has yet to be realised and because there has not been sufficient or extensive independent long-term research.

2.2 While often biotechnology companies will claim that genetic engineering in agriculture is simply an extension of previous and conventional breeding, this is not true. Genetically engineered organisms are a completely new technique and differ greatly different from conventional techniques of selective breeding, mutagenesis, cell fusion and tissue culture (Mae Wan Ho, 1999)

2.3 Informed Comment

Dr Maewan Ho states that: *"Once inside the cell, the vector carrying the genes will insert into the cell's genome. A transgenic organism is regenerated from each transformed cell which has taken up foreign genes. And from that organism, a transgenic variety can be bred. In this way, genes can be transferred between distant species which would never interbreed in nature."* (Mae Wan Ho, 1999).

Scientific References

Mae-Wan Ho PhD, (1999*) "Special Safety Concerns Of Transgenic Agriculture and Related Issues",* Briefing Paper for Minister of State for the Environment, United Kingdom, The Rt Hon Michael Meacher*, in Institute for Science and Society, ISIS News, (3)* www.isis.org.uk

3.0 Effects on Other Species From Genetically Engineered Plants, Crops and Animals

The full implications of this new technology in our agricultural production has yet to be realised. It is possible and likely that those animals, plants and other life forms which share the same ecosystems as genetically engineered organisms may well be adversely and irreversibly affected.

3.1 There have been very few studies which have completed independent research in this area. Perhaps even more alarming is that from the few studies completed, there has already been established cause for concern.

3.2 The prominent study by researchers at Cornell University found that genetically engineered corn plants had a devastating effect on the monarch butterfly. Milkweed leaves, which monarch butterflies eat almost exclusively, grow around areas in the United States where genetically engineered corn is grown. These leaves were dusted with pollen from the transgenic corn and fed

to the monarch butterfly larvae. As a consequence, these larvae grew more slowly and had a higher death rate than did the control group (Losey et al, 1999).

3.3 A further field study by different researchers, (Hansen et al, 2000) confirmed the results of Losey et al (1999). The study conducted three kinds of studies using two types of Bt corn. The Bt corn was marketed by Novartis Seeds - KnockOut and YieldGard. The experiments consisted of the following procedures and findings:

3.3.1 They calculated pollen content which naturally fell on milkweed leaves near plantations of all three types of Bt corn. They found that the amount of Bt pollen deposited on the milkweed leaves was of a sufficient amount to kill monarch caterpillars.

3.3.2 To maintain natural field exposure conditions, they placed the caterpillars on pieces of leaves taken from within and at the edges of KnockOut plantations and non-Bt corn plantations. They then calculated the number of dead larvae which remained after two days. Significantly more caterpillars died after feeding on Bt pollen leaves than those of non-Bt corn pollen.

3.3.3 Finally they examined the range of Bt pollen densities similar to those encountered in the field. The caterpillars were exposed to leaves containing KnockOut and YieldGard Bt corn pollen and also included non-Bt corn pollen. The mortality rate for caterpillars was significantly greater on the highest densities of Bt corn pollen of both KnockOut and YieldGard, than non-Bt corn pollen. At the very lowest density, the caterpillars survived equally well on both Bt corn pollen and non-Bt corn pollen.

3.4 The researchers believe that their study suggests that monarch butterfly caterpillars will be most greatly effected if they eat from milkweed leaves which grow inside Bt cornfields or within three metres of the edges of the cornfields. Commonly this is often where milkweeds are found, either on the edges or within the corn field plantations themselves (Hansen, 2000).

Scientific References

Losey, JE., Raynor, LS and Carter, ME., (1999), 'Transgenic Pollen Harms Monarch Larvae', *Nature,* 399, 20 May, 214.

Hansen, LC., Obrycki, J.J., (2000) 'Field Deposition of Bt Transgenic Corn Pollen: Lethal Effects on the Monarch Butterfly', *Oecologia,* DOI 10.1007/s004420000502, published online 19 August.

3.5 These two studies indicate that the use of Bt corn has the potential to seriously affect monarch butterfly populations where such plantations exist. Effects

from losing such insects could reverberate through the entire food chain and disrupt fragile ecosystems with unknown results. Further implications from the release of genetically engineered organisms into the environment, is that once released transgenic crops can spread their seeds and pollen, and interbreed with other closely related plant species just as conventional plants do.

3.6 This risk of cross-pollination of genetically engineered plants with conventional plants means that within the use of field trials or commercial release plantations, a buffer zone is usually recommended. However the adequacy of a buffer zones is questionable when bees can travel for more than five kilometres in search of pollen (Nicholsen-Lord, 1999).

References

Nicholson-Lord, D., (1999), 'The Natural Result of Genetic Change', *The Independent*, GM Foods 5, London.

3.7 A study published in Nature outlined research on the promiscuity of transgenic plants to outcross with other nearby relatives. When comparing two different types of herbicide resistant mustard plants, one derived from genetic engineering technology and the other from traditional breeding, the transgenic variety was twenty times more likely to interbreed with nearby relative plants than the traditional ones (Bergelson et al, 1998). The reason for this remains unknown, but it does point to the unknown abilities and qualities of genetically engineered organisms once they are released into the environment. This increase in promiscuity of the transgenic plant was not an intended effect and raises important questions about how much is known regarding the flow on effects once these plants are introduced into natural populations.

3.8 Further risks to the environment come from the instability and unpredictability of genetically engineered plants once they have been released into the environment. Nature may take over and mean that in the end, we have little control over how the plants interact in the environment.

3.9 Informed Comment:

Peter Wills – Associate Professor in Physics at Auckland University states: *"What has not been considered is that nature's adjustments will be ultimately uncontrollable and can be expected to include new phenomena with a 'life' of their own. Genetic Engineering will create new, propagative phenomena as side effects of its intended results."* (Wills, 1999).

3.10 Muir and Howard found that possible ecological risks from transgenic fish release could include mating with other local populations. The mating may then cause a reduction in viability for offspring of both populations and may lead to eventual local extinction. They state: "Local extinction of a wild-type population from a release of transgenic individuals could also have cascading negative effects on the community." The authors also indicate that transversely this could also serve as a means of biological control (Muir and Howard, 1999).

3.11 However, these possible effects have widespread ramifications for local populations and for the ecosystems. A form of this type of biological control would be extremely risky and uncontrollable once released. This study highlights more predominantly however the extreme risk that mating of transgenic organisms with local populations could serve, that is the reduced viability of both populations which could result in the eventual extinction of both populations (Muir and Howard, 1999). This risk is one which is irreversible and irreparable. Already we have seen the effects of extinction of species and the resulting effects on the earth. Each time we lose a species, the Earth is a little poorer.

3.12 Birds could also be affected by genetically engineered herbicide-tolerant crops. Watkinson, Freckleton, Robinson and Sutherland (2000) used a computer model which tested theoretically the impact from genetically engineered sugar beet on wild bird populations of skylarks. They state: "We predict that weed populations might be reduced to low levels or practically eradicated, depending on the exact form of management. Consequent effects on the local use of fields by birds might be severe, because such reductions represent a major loss of food resources" (Watkinson et al, 2000). The impacts of genetically engineered herbicide tolerant crops will depend on whether their adoption covaries with the existing weed levels in the area.

3.13 The actual effects from the Bt toxins in some varieties of genetically engineered herbicide tolerant crops are also under much investigation. Benbrook (1999) outlines the findings of a report which states that the common Bt-transgenic corn releases Bt toxin through root exudates. The report and research states that the activated Bt toxin is exuded through the roots. Where it then binds with soil particles and exists in the soil and maintains its toxicity for 243 days. This means that the existing levels of Bt toxin from the first season will be increased because of the residues released from the corn plants grown later in the year (Benbrook, 1999).

3.14 The researchers of the study upon which Benbrook comments, Saxena, Flores & Stotzkey (1999) state that they:

"...have no indication of how soil communities might be affected by Bt toxin in root exudates in the field. Bt toxin in the rhizosphere might improve the control of insect pests, or it might promote the selection of toxin-resistant target insects. Receptors for the toxin are present in non-target as well as target insects, so there may be a risk that non-target insects and organisms in higher trophic levels could be affected by the toxin. Further investigations will be necessary to shed light on what might happen underground."

3.15 The uncertainty of what these increased levels of Bt toxin in the soil points to the need for caution. We have many previous examples where technology has had devastating effects on the environment. The speed of introduction of these plants overseas may well result in widespread irreversible consequences.

3.16 Informed Comment

"It is urgent to have a moratorium for transgenic insect resistant plant in order to save one of the most valuable biological pesticides. This moratorium is also necessary to prevent genetic pollution via out-crossing. The changed

toxin may have the potential to kill others than non-target organisms which possibly will have far-reaching consequences in different environments. There is now more evidence that insect-resistant transgenic plants have negative impacts on both sustainable agriculture and the environment" (Tappeser, 1997).

3.17 Stotzky and Crecchio (cited in Gene Exchange, Union of Concerned Scientists, 1998) found in their study that purified Bt toxins (similar to those ones which are found in some lines of genetically engineered Bt crops) did not disappear or degrade into the soil. Instead the Bt toxins quickly bound themselves to particles in the soil. Once this had been accomplished, the Bt toxins existed in a potent condition and had not lost the ability to kill insects living within the soil.

3.18 The build up of Bt toxins in the soil is potentially a risk to the soil ecosystem. The Gene Exchange (produced by the Union of Concerned Scientists) comments on this study: "The accumulation of active Bt toxins in soils could represent a risk to soil ecosystems. Typically toxins in naturally occurring Bt bacteria, and sprays made from then, are not active – they exist in the form of inactive, so-called protoxins. Before they are able to kill an insect, the protoxins must be dissolved in its gut and cut by protein-digesting enzymes liberating the active toxins. By contrast, the toxin in many Bt crops needs no activation. It is already in an active form" (Union of Concerned Scientists, 1998)

3.19 This has huge ramifications for soil ecosystems and highlights potential risks to the environment. The build up of these active Bt toxins over time could have devastating effects on those insects which are affected by Bt.

3.20 Not only can genetically engineered plants have potential hazards for the environment, but all genetically engineered organisms once released have the potential to cause great harm to the environment. In the example of genetically engineered bacteria – Klebsiella planticola, the potential hazards can be seen. The bacterium was engineered with the root-zone novel ability which made it capable of producing ethanol. The researchers found that the addition of the genetically engineered microorganism to a small microcosm of wheat plants and sandy soils killed the plants, whereas as the addition of the non-genetically engineered parent did not (Holmes et al, 1998). This study highlights the devastating effects that a genetically engineered microorganism could have, had it been released. The effects would have been far reaching, and impossible to eliminate from the environment.

Scientific References

Bergelson, Joy, Purrington, Colin B., and Wichmann, Gale, (1998), 'Promiscuity in Transgenic Plants', *Nature,* vol. 395, September 3, pg 25.

Wills, Peter (1999) 'Assessing the Ecological Effects of Releasing Genetically Engineered Organisms into the Environment', *Soil and Health: The GE Issue,* July, 48-51.

Muir, William M. and Howard, Richard, D., (1999), 'Possible Ecological Risks of Transgenic Organism Release When Transgenes Affect Mating

Success: Sexual Selection and the Trojan Gene Hypothesis", *PNAS,* vol. 96, no. 24, 13853-13856.

Watkinson, A. R., Freckleton, R. P., Robinson, R. A., and Sutherland, W. J., (2000) 'Predictions of Biodiversity Response to Genetically Modified Herbicide-Tolerant Crops', *Science,* vol. 289, 1554-1557.

Benbrook, Charles M. (1999) "Commentary On 'Insecticidal Toxin In Root Exudates From Bt Corn", December 2, http://www.biotech-info.net/exudates_cmb.html

Saxena, Deepak; Flores, Saul & Stotzkey, G (1999) 'Insecticidal Toxin in Root Exudates from Bt Corn', *Nature,* v 402, 2 December, 480.

Tappeser, Beatrix from Institute for Applied Ecology, Freiburg, Germany (1997) 'The Differences Between Conventional Bacillus Thuringiensis Strains and Transgenic Insect Resistant Plants', *Prepared for the Third Open-Ended Working Group on Biosafety,* October 13-17, Montreal.

Union of Concerned Scientists, (1998) *The Gene Exchange,* Fall/Winter, http://www.ucsusa.org/Gene/w98.risk.html Study cited from Crecchio, C. and Stotzy, G., (1998) 'Insecticidal Activity and Biodegradation of the Toxin from Bacillus Thuringiensis Subsp. Kurstaki Bound to Humic Acids from Soil', *Soil Biology and Biochemistry,* 30: 463-70.

Holmes et al, (1998), 'Effects of Klebsiella Planticola on Soil Biota and Wheat Growth in Sandy Soil', *Applied Soil Ecology,* 326: 1-12.

4.0 Biodiversity

In addition the use of biotechnology in agriculture may seriously undermine and threaten biodiversity. Instead of many different varieties of a particular crop planted each season, genetically engineered seeds need to be proven to be constructed and able to maintain a uniform product. This means that any resulting progeny from the genetically engineered seeds will be extremely similar to the parents, if not identical. This will have serious effects on plant biodiversity, once these seeds are planted and released on a large scale (Lappe and Bailey, 1998).

4.1 Biodiversity in agriculture is an important tool because it means that if disease or blight or rot attacks, it usually won't affect all varieties of a specific plant. The limited seed varieties produced by biotechnology companies don't give the same protection for the food supply as biodiversity. This crop uniformity is present in both conventional seed breeding from companies, and genetically engineered seeds from biotechnology companies (Lappe and Bailey, 1998).

4.2 "Wild plants are under constant pressure from pathogens, pests, severe climates and unfavourable soils. As a result, they have evolved a myriad of strategies for survival including thorns, natural toxicity and fibrous tubers. Many of these defensive characteristics, maintained as part of the reservoir of genetic diversity, are being progressively lost through domestication. Genetic

engineers drive this process still further by isolating a small subset of these traits and putting them into a selected small number of cultivars" (Lappe and Bailey, 1998).

Scientific References

Lappe, M & Bailey, B., (1998) *Against the Grain: Biotechnology and the Corporate Takeover of Your Food,* Monroe, Common Courage Press.

5.0 Conclusion

GE Free New Zealand considers that the potential risks to the environment from the release of genetically engineered plants, crops, and animals is unacceptable. We believe that these risks are too large in their possible impact and ramifications to make the introduction of genetically engineered crops, plants and animals into the environment an option. **We oppose the introduction of all and any genetically engineered crops, plants and animals into the environment because of the unacceptable level of risk this would pose and because of the irreversible nature of this technology in agriculture.**

Section B (m)

B (m) the range of strategic outcomes for the future application or avoidance of genetic modification, genetically modified organisms, and products in New Zealand
Section B (m) Summary Expansion of organic agriculture production methods is the best strategic outcome for New Zealand. (1.0) **B (m)**

1.0 We believe that the most sustainable option for New Zealand is by the avoidance of genetic engineering in agriculture production. The expansion of organic agriculture will be the best strategic outcome for New Zealand.

Section B (n)

B (n) whether the statutory and regulatory processes controlling genetic modification, genetically modified organisms, and products in New Zealand are adequate to address the strategic outcomes that, in your opinion, are desirable, and whether any legislative, regulatory, policy, or other changes are needed to enable New Zealand to achieve these outcomes
Section B (n) Summary

Changes are necessary to reflect the adoption of A(1) and A(2) in this submission (1.0).

B (n)

1.0 GE Free New Zealand considers that major changes in legislation, regulations and policy changes are necessary to reflect the adoption of our recommendations in section A (1) and A (2) from this submission under the terms of reference.