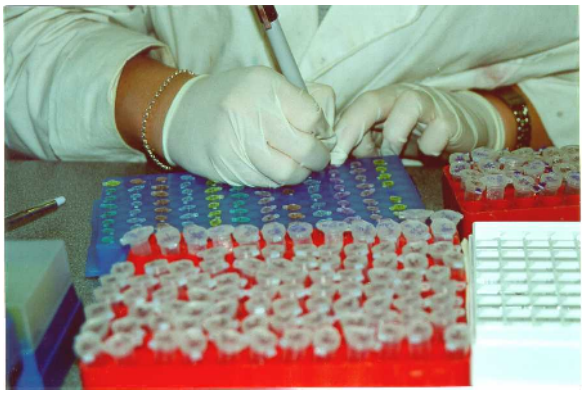
Discussion Paper

GENE TECHNOLOGY IN THE AUSTRALIAN GRAINS INDUSTRY

3 September 2001



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Overview

Some aspects of the use of biotechnology or more accurately, gene technology, to produce improved and/or transgenic crops have given rise to community concerns regarding its food and environmental safety, and moral and ethical implications. This partly due to the recency in the availability and the development and application of gene technology. Concern is exacerbated because of confusion resulting from the terminology used to explain the science. Additionally there is concern in relation to the safety of foods, with confusion among consumers about the difference between genetically modified crops that make use of same species genes, vis transgenic crops that make use of genes from different species.

Misinformation and the development of urban myths surrounding unsubstantiated claims of the impact on the farming landscape and human health of crops that have been genetically manipulated adds to the fragmentation of the debate over GM in general. Examples include the threat to monarch butterflies from genetically modified corn or the implanting of fish genes into tomatoes to confer increased cold tolerance.

Many argue that gene technology can provide significant benefits to producers, consumers and the environment through the development of crops with desirable agronomic and/or consumer attributes. Gene technology is a tool that can be combined with organic and conventional farming methods to achieve a common goal of safe, abundant and sustainable food supply.

Because the science is comparatively new, it may not be without risks, not all of which may be fully understood at this time. This total lack of risk is reflected in various regulations that have been enacted to ensure research and development is scientifically, socially and ethically responsible.

Modern biotechnology - gene technology

Biotechnology as a tool for the modification or production of products is not a new concept. Indeed, its use extends back several thousand years when applied to the manufacture of foodstuffs such as cheese, bread and early versions of beer.

A significant issue in the debate on GMO is as much about agreement on terms as it is about the health and safety aspects of its application. The term **modern biotechnology** is widely used and relates to the use of specific scientific tools made possible by the discovery of DNA in the 1950s. However the abbreviation of the term back to biotechnology creates issues in its own right. Therefore this paper uses the term **gene technology** and this is used to describe tools such as molecular markers*, functional genomics, and DNA fingerprinting used in the development of improved plant species and pest management methods. These tools are used to enhance crops through the efficient integration of desirable genes from the same species or other plant or animals. In effect it is a marriage of technology and nature, using the genetic research to bring out the best that naturally resides in plants. These tools can also be used to introduce genes from foreign organisms to confer specific traits and

* **Molecular markers** are specific sets of base sequences (strings of C, G, A and T) along a living thing's chromosomes and are highly individual.
Functional genomics is the study of what traits/functions are conferred to an organism by given [gene] sequences.
Gene Expression is achieved through the conversion of the genetic information within a gene, into an actual protein (or cell process).
DNA fingerprinting is the process of identifying the specific sequence of DNA molecules.

produce **transgenic** crops. A prime example in Australia is Bt cotton, which uses genes from the *Bacillus thuringiensis*, soil bacterium to provide protection against the heliothis caterpillar. Increasingly, the term GMO is being widely used to identify with transgenic plants rather than its more correct application of any plant or animal that has exotic or same species gene manipulation. The result can be broadly classified as genetically modified organisms (GMOs). Some argue that gene technology is not required to produce GMO's - and that the development of wheat through traditional plant breeding of various grass species over thousands of years is used to prove this point.

Gene technology has been a feature of the grains industry for a number of years and used as part of the plant breeding process to bring varieties with desirable agronomic and consumer attributes to market more rapidly.

Some examples of gene technology and their applications in Australian research include:
Molecular markers to help in the identification and utilisation of genes that confer traits for disease resistance, pest resistance and crop physiology attributes in crops as diverse as winter and summer cereals, pulses and oilseeds. This technology is also being used by entomologists to identify genes in insects that provide resistance to chemicals in cropping and stored grain situations. *(Molecular markers are specific sets of base sequences (strings of C, G, A and T) along a living thing's chromosomes and are highly individual.)*

Gene discovery through functional genomics to identify and utilise trait of genes for crop improvement. Examples include identifying and using genes to increase nutrition and pest resistance, drought tolerance. *(Functional genomics is the study of what traits/functions are conferred to an organism by given [gene] sequences).*

Gene expression is used to determine what and when a gene does in the life cycle of a plant. An example is a gene's control of the timing of flowering. *Gene Expression is achieved through the conversion of the genetic information within a gene, into an actual protein (or cell process). Note that many genes are only expressed at specific times during the lifetime of an organism. Some genes are expressed in a "cascade" of related expressions.*

DNA fingerprinting identifies the specific and unique sequence of DNA molecules. It can be used to support Plant Breeders Rights applications, determine if fields have been contamination with plants of a second variety and to determine the origins of disease. (*DNA fingerprinting is the process of identifying the specific sequence of DNA molecules. Because all DNA is unique, this allows matching of biological samples with its host - ie.)*

Another technique that is not strictly gene technology, but is also used in modern plant breeding is the process called doubled haploid. This allows plant breeders to achieve astable chromosomal number through tissue culture and effectively removes four years from the development time of new varieties of wheat and barley.

Gene technology and the producer

The benefits of the application of gene technology for producers include; faster development of grain crops that are more resistant to insect pests and diseases, have growth and yield advantages and produce grains with quality attributes that are sought-after by domestic and international end users. These attributes can also be expressed economically through reduced applications of chemicals for pest and disease control and improved margins resulting from higher yield. Environmentally, the farming system can benefit through a reduced impact on the ecosystem.

With advances in the scope and application of gene technology, an increasingly diverse range of benefits will emerge. These will range from improved capacity to utilise marginal land, to production of crops for supply to specialist bioindustries, the majority of which do not yet exist, and for the production of functional foods that confer health benefits in addition to the basic food value of the product. The development of new and improved products will be carried out under regulatory guidelines, including the Office of the Gene Technology Regulator.

While there are a great number of benefits for producers to emerge from gene technology, there are a number of issues raised by anti GM proponents. The first is the question of ownership of genes and the capacity for companies owning those genes to exert financial or other pressures on producers for access to planting seed. There are some who fear companies may be placed in a position to hold producers and consumers to financial ransom by charging excessive prices for seed.

Community sentiment and terms such 'traitor technologies' and 'frankenfoods' used by anti gene technology proponents to deliberately engender fear and anxiety has the potential to create negative sentiments towards producers who may be perceived as extending damage on the environment or consumers of their product. While commercial crops may not be the targets of extremist attacks, as has occurred in France in recent weeks, the Office of the Gene Technology Regulator requirement to publicly disclose the location of GM crop trials may see anti GM activists damage private or public GM crops under trial.

International concerns over GM crops may also have a negative impact on export opportunities. Europeans have widely protested against genetically modified crops while public concern in Japan is also high. Sri Lanka has recently banned the importation of all genetically modified foods. The concern is not limited to general community organisations, with the Canadian Wheat Board joining 210 industry associations, agricultural groups and researchers who asked the Canadian Government to delay introduction of genetically modified wheat until scientific research establishes its safety. The Canadian Wheat Board's reasons were based on concerns that Canada risks losing international markets for one of its best known exports, reflecting consumer doubts about the health and environmental impacts of genetically modified products. Further insights into the view in the United States on this aspect are outlined in the document *Statement on Agricultural Biotechnology*, which is attached to this paper.

Publicised examples both documented and non documented, of negative environmental impacts include: Self pollinating plants cross-pollinating with other

plants; the spread of GM canola seeds and pollen into neighbouring paddocks; herbicide resistant crops entrenching herbicide use and consequently damaging the environment; virus resistant plants becoming infected with exotic viruses leading to the evolution of new viruses; and insect resistance. This is covered in more detail on page 7.

Gene technology and the consumer

Consumer reaction to gene technology and genetically modified organisms is mixed and influenced by an overall lack of information, with information from the pro side of the debate often using terminology that is too complex for the consumer to understand. This is in stark contrast to the anti-GMO lobby making skilful use of emotive language and claims that are not always based on scientific evidence. There have been some instances internationally, however, where scientists involved in gene technology have begun to voice concerns over the work they are undertaking. These concerns are generally related to claims that not enough testing has been done on foods to establish long-term health effects of consuming genetically engineered food. These claims can be further explored at http://www.ucsusa.org/agriculture/0biotechnology.html.

This indicates that the debate on food labelling of GMO ingredients is perhaps premature if consumers do not understand what the information on the label means and there is a high level of conflicting argument as to the safety of food.

Australian public attitudes to GMO issues have been captured in a July 2001 survey by Biotechnology Australia, which released the following changes since 1999:

- Increased awareness of biotechnology issues (57% to 67%)
- Increased acceptance of some applications, such as modifying crops to make them more pest resistant (31% to 37%),
- Increase in the percentage of the population who believed genetic engineering would improve our lives over the next 20 years (from 42% to 51%).

While in some cases the percentage changes are not significant, the underlying levels do provide a measure of the Australian public's attitude to GM. Other key points from the survey included:

- People are interested in science
- Increased awareness of the application of biotechnology
- Far greater acceptance of GM in crops for disease and pest protection that for medical uses where benefit for consumer is less refined.
- People have difficulty relating crops with food
- GM in food for improved taste is seen as trivial

A significant aspect of gene technology in food vis medicine revealed by the survey is consumers felt comfortable about using medicinal products produced using gene technology compared with eating crops which had been genetically modified for reasons other that pest/disease management. The survey revealed this was because medicinal use was arrived at through a process of informed choice (often in consultation with doctors) whereas there was little choice in relation to food.

The survey also revealed that while 80 percent of the community had concerns about gene technology (levels related to gene technology related to animals and humans was significant) these concerns rated much lower than environmental concerns, such as pollution and greenhouse gasses.

One area of confusion among consumers is the difference between genetically modified crops that make use of same species genes, vis transgenic crops that make use of genes from different species. While the scientifically correct use of the term is anything that has a gene introduced through gene technology, the most popular application of the term transgenic is an organism that contains genes from another species.

The use of gene technology holds a range of benefits for the consumer both directly and indirectly. Reductions in chemical usage to manage pests and diseases have immediate benefits in the grains and horticulture industries. A follow-on benefit in is improved grain quality for processors and marketers, which in turn affect the quality and price of the final product on the supermarket shelves.

The Biotechnology Australia survey finding relating to concerns for the environment shows another tangible benefit for consumers and producers. The reduction and in some cases elimination of the need to spray chemicals to control pests (as in the case of sorghum midge) leads to significant environmental benefit of non target species being maintained and providing the foundations for integrated pest management leading to greater insect biodiversity. This helps meet consumer expectations of producers protecting the environment through sustainable farming practices.

However, food safety issues still remain and pose a challenge for scientists to clearly address concerns including real or perceived concerns that mutagens, allergens and toxins may be introduced to consumers via foods containing GM food components.

Risks of Genetic Engineering

While there are many who believe that genetic engineering will prove to be the ultimate saviour against pests, disease, low yield and environmental adaptation, there is also a segment of the community who claims that there are serious environmental and health risks associated with altered crops.

The following information is an abridged version of a fact sheet issued by the Union of Concerned Scientists (http://www.ucsusa.org/ucs-home.html) that covers many of the aspects of public concern.

"It is not true that all genetically engineered foods are toxic or that all released engineered organisms are likely to proliferate in the environment. But specific engineered organisms may be harmful by virtue of the novel gene combinations they possess. This means that the risks of genetically engineered organisms must be assessed case by case and that these risks can differ greatly from one gene-organism combination to another. So far, scientists have identified a number of ways in which genetically engineered organisms could potentially adversely impact both human health and the environment. Once the potential harms are identified, the question becomes how likely are they to occur. The answer to this question falls into the arena of risk assessment.

Potential Harms to Health

Here are the some examples of the potential adverse effects of genetically engineered organisms may have on human health. Most of these examples are associated with the growth and consumption of genetically engineered crops. Different risks would be associated with genetically engineered animals and, like the risks associated with plants, would depend largely on the new traits introduced into the organism.

New Allergens in the Food Supply. Transgenic crops could bring new allergens into foods that sensitive individuals would not know to avoid. Some genetic engineering involves moving proteins into the food supply from organisms that have never been consumed as foods. Some of those proteins could be food allergens, since virtually all known food allergens are proteins. Recent research substantiates concerns about genetic engineering rendering previously safe foods allergenic. A study by scientists at the University of Nebraska shows that soybeans genetically engineered to contain Brazil-nut proteins cause reactions in individuals allergic to Brazil nuts. Scientists have limited ability to predict whether a particular protein will be a food allergen, if consumed by humans.

Antibiotic Resistance. Genetic engineering often uses genes for antibiotic resistance as "selectable markers." Early in the engineering process, these markers help select cells that have taken up foreign genes. Although they have no further use, the genes continue to be expressed in plant tissues. Most genetically engineered plant foods carry fully functioning antibiotic-resistance genes. The presence of antibiotic-resistance genes in foods could have two harmful effects. First, eating these foods could reduce the effectiveness of antibiotics to fight disease when these antibiotics are taken with meals. Second, the resistance genes could be transferred to human or animal pathogens, making them impervious to antibiotics.

Production of New Toxins Many organisms have the ability to produce toxic substances. For plants, such substances help to defend stationary organisms from the many predators in their environment. Addition of new genetic material through genetic engineering could activate inactive pathways in plants that produce toxins or otherwise increase the levels of toxic substances within the plants.

Concentration of Toxic Metals. Some of the new genes being added to crops can remove heavy metals like mercury from the soil and concentrate them in the plant tissue. The purpose of creating such crops is to make possible the use of municipal sludge as fertilizer. Turning on the genes in only some parts of the plants requires the use of genetic on/off switches that turn on only in specific tissues, like leaves. Such products pose risks of contaminating foods with high levels of toxic metals if the on/off switches are not completely turned off in edible tissues. There are also environmental risks associated with the handling and disposal of the metal-contaminated parts of plants after harvesting.

Potential Environmental Harms

Increased Weediness. One way of thinking generally about the environmental harm that genetically engineered plants might do is to consider that they might become weeds. Here, weeds means all plants in places where humans do not want them. A new combination of traits produced as a result of genetic engineering might enable

crops to thrive unaided in the environment in circumstances where they would then be considered new or worse weeds. One example would be a rice plant engineered to be salt-tolerant that escaped cultivation and invaded nearby marine estuaries.

Gene Transfer to Wild or Weedy Relatives. Novel genes placed in crops will not necessarily stay in agricultural fields. If relatives of the altered crops are growing near the field, the new gene can easily move via pollen into those plants. The new traits might confer on wild or weedy relatives of crop plants the ability to thrive in unwanted places, making them weeds as defined above.

Change in Herbicide Use Patterns. Crops genetically engineered to be resistant to chemical herbicides are tightly linked to the use of particular chemical pesticides. Adoption of these crops could therefore lead to changes in the mix of chemical herbicides used. Widespread use of herbicide-tolerant crops could lead to the rapid evolution of resistance to herbicides in weeds, either as a result of increased exposure to the herbicide or as a result of the transfer of the herbicide trait to weedy relatives of crops.

Squandering of Valuable Pest Susceptibility Genes. Many insects contain genes that render them susceptible to pesticides. Often these susceptibility genes predominate in natural populations of insects. These genes are a valuable natural resource because they allow pesticides to remain as effective pest-control tools. The more benign the pesticide, the more valuable the genes that make pests susceptible to it. Certain genetically engineered crops threaten the continued susceptibility of pests to one of nature's most valuable pesticides: the Bacillus thuringiensis or Bt toxin.

Unknown Harms. As with human health risks, it is unlikely that all potential harms to the environment have been identified. Each of the potential harms above is an answer to the question, "Well, what might go wrong?" The answer to that question depends on how well scientists understand the organism and the environment into which it is released. At this point, biology and ecology are too poorly understood to be certain that question has been answered comprehensively.

Risk Assessment

Having identified a list of possible harms that might occur as a result of using or releasing genetically engineered organisms, the next question is how likely are any of these to occur? Like the original "brainstorming" of potential harms, the answer to this question depends greatly on how well the organisms and their interaction in the environment are understood. Risks must be assessed case by case as new applications of genetic engineering are introduced. In some circumstances, it is possible to assess risks with great confidence. For example, it is unlikely that genetically engineered palm trees will thrive in the Arctic regardless of what genes have been added. But for many potential harms, the answers are far less certain."

Abridged version sourced from UNION OF CONCERNED SCIENTISTS
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Cambridge, MA 02238
617-547-5552

In addition to the information above which may be argued for or against, there remains two significant and very real aspects that can be viewed negatively in the

gene technology debate in its application to the Australian grains industry and several that may have a future impact;

Market acceptance
As outlined on page 5 of this paper, there are significant concerns by grain importing countries, some of whom are buyers of Australian grains, as to the desirability of importing GM grain. The adoption or otherwise of GM grains, including herbicide resistant canola and wheat needs to be seriously considered in view of its saleability into many international markets.

Cost of identity preservation
Attachment 4 of this paper provides an abridgement of the Summary of the ABARE publication 'Genetically modified grains - Market implications for Australian grain growers. This is recommended reading and covers the potential economics of the production cost savings through the use of GM crops vs the cost of implementing and maintaining and identity preservation system.

Legal issues - who is responsible?
In the United Sates there is a growing concern over who is liable when something goes wrong with GM crops, whether from potential pollen contamination of neighbouring crops, accidental mixing of GM and non-GM harvested grain. The recommendations circulating in the United States suggest that insurance policies need to be clarified.

IP restrictions, access and price
It cannot be guaranteed that the high cost of developing GM costs and the desire for the owners of the intellectual property (including the 'ownership' of genes) may not be passed onto buyers of planting seed. The benefits conferred by the GM crop may result in a situation where the affordability of seed becomes an issue.

Gene technology and the organics industry

The Australian organics industry's view on the use of gene technology in crop development is mixed, and is likely to remain unclear for the foreseeable future due to the differing views of the various certifying organisations. Some organic certification organisations accept crops that have been modified using gene technology as a tool to assist traditional plant breeding and that are not transgenic. Other parts of the industry, however, appear determined to remain resolute to total rejection.

It would be prudent for the Australian grains industry to work with the organic industry to best identify common goals in production of safe and nutritionally acceptable food. In many cases the use of crops developed for improved disease resistance may alleviate the need for use of chemicals (such as copper sulphate for the control of potato blight) that may cause serious health issues for farm workers and could be harmful to soil fauna.

Debate on biotechnology - Australia vis the world

Despite gene technology having been used in Australia for 15 years, the level of debate on its use by the public and at higher levels lags behind many other countries. In Canada, the debate on the pros and cons of the applications of gene technology is highly public, while in the European Union public sentiment relating to the health

aspects of gene technology have been heightened by Mad Cow Disease and the overall concern about the health aspects of food in general. Sri Lanka has become the first country in the world to totally reject the importation of any genetically modified food, while other countries are providing market opportunities for non-genetically modified food.

In recent weeks New Zealand has openly debated to GM issue through the Royal Commission, while at home Tasmania is resolute in its desire to remain a GM free zone based on their reading of market opportunities for non-GM crops.

Recently the United Nations was cited as saying in its Human Development Report 2001 Tuesday, that rich countries need to put aside their fears of genetically modified organisms and help developing nations unlock the potential of biotechnology. The UN stated, "Biotechnology offers the only or the best 'tool of choice' for marginal ecological zones, left behind by the green revolution but home to more than half the world's poorest people". The UN's view is that new crops, genetically enhanced to resist drought, pests and disease, could help reduce the malnutrition that affects 800 million people worldwide.

In Australia, the Australian Conservation Foundation's GeneEthics Network is perhaps the most vocal lobbyist against gene technology in food. As recently as August 28, 2001, they were calling for a five year freeze on genetically engineered crops, claiming "genetically engineered crops were being recklessly pushed on Australian farmers and consumers…the benefits promised by chemical giants and governments were a hoax".

The debate may intensify in Australia towards the end of the year with the introduction of new food labeling requirements. Food manufacturers are reportedly already looking to source non GM products where possible to avoid any consumer backlash.

Regulation and gene technology

In June 2001, Australia's new gene technology regulatory regime commenced operation, administered by the Office of the Gene Technology Regulator. The OGTR is a Commonwealth regulatory agency located within the Health and Aged Care portfolio and was established by the *Gene Technology Act 2000* (GT Act) to be responsible for a national scheme to regulate genetically modified organisms (GMOs).

> The main objective of the *Gene Technology Act 2000* is:
> *"to protect the health and safety of people, and to protect the environment, by identifying risks posed by or as a result of gene technology, and by managing those risks through regulating certain dealings with genetically modified organisms."*

The GT Act regulates all dealings (e.g. research, manufacture, production and importation) with organisms that have been modified by gene technology. It is the intention of the Act to create a streamlined pathway for industry and researchers seeking approval for GMO's and genetically modified products that can be managed safely.

As part of the disclosures required by the OGTR is that the location of trial sites must be made publicly available. This information is available on the OGTR website.

In addition to the Commonwealth's Gene Technology Act, the application of biotechnology in Queensland is covered by a state bill and a state code of practise. On September 12, 2001, the *Gene Technology Bill 2001* (Queensland) was introduced into the Queensland Parliament. Mirroring the Commonwealth Act, this Bill is expected to take effect from January 2002 and provides for heavy penalties for non-compliance.

A voluntary *Code of Ethical Practices for Biotechnology in Queensland* was introduced by the Queensland Government on September 1, 2001. The Code summarises the basic ethical commitments that should apply to all biotechnology research and development in Queensland. The Queensland Government will not support research or applications that fail to meet the agreed safety standards or pose unacceptable risks. This includes:

- Comply with all relevant State and Commonwealth legislation
- Practise integrity (the organisation must report accurately on the results of research, including negative results)
- Cooperate with relevant authorities to ensure that biotechnology products are fully assessed for adverse impacts on human safety or for the environment
- Ensure genetically modified crops do not damage the environment.

Copies of this code can be found at www.biotech.qld.gov.au

In Western Australia, the government of policy on GMO's is expected to be made soon. Tasmania has introduced a temporary moratorium on growing GM plant and plant materials other than in authorised contained research until a policy position is reached. There is no specific Act or Bill relating to gene technology that can be identified in the Northern Territory, Western Australia, South Australia or NSW.

Brief descriptions of other product regulatory agencies and their roles are provided here. Further information can be found at the agency web sites.

Acronym	Full Name	Responsibility
ANZFA	Australia New Zealand Food Authority	ANZFA maintains the Food Standards Code and develops food standards to guard the safety of Australia's food supply. If a GMO is used in the production of food or is in a food itself, safety for consumption is assessed by ANZFA before the food is permitted onto the market.
TGA	Therapeutic Goods Administration	The TGA assesses the safety, quality and efficacy of all therapeutic goods available in Australia. If a GMO or product of genetic manipulation technology has therapeutic uses, it will be subject to approval and regulation by the TGA.
NRA	National Registration Authority	The NRA operates the Australian system that conducts safety evaluations, registers and regulates agricultural and veterinary chemicals. NRA's

		rigorous assessment process to ensure that it meets high standards of safety and effectiveness. If a GMO or product of gene manipulation technology has herbicidal or pesticidal action, it may be subject to registered by the NRA.
NICNAS	National Industrial Chemicals Notification and Assessment Scheme	NICNAS under the Industrial Chemicals Act assesses substances that are produced by a GMO that meet the definition of 'industrial chemical'. These include dyes, solvents, plastics and photographic chemicals, as well as some chemicals used in the home such as paints, cleaning agents and cosmetics.
AQIS	Australian Quarantine and Inspection Service	If a GMO is being imported from overseas, AQIS is responsible for making sure it will not endanger plants, animals and human life or health.

Conclusion

The debate into the use of gene technology in the production of foods including grains is one that is unlikely to be resolved in the near or foreseeable future. In light of the lack of vigorous public debate on the subject in Australia, it may be assumed that the heat of public sentiment has yet to reach its peak, or perhaps is representative of the Australian culture of acceptance of new technologies.

The grains industry has many benefits to be gained from the application of gene technology. Active participation in the GMO debate by the grains industry may be required in order to reassure the public that foods are being produced in an ethical manner under a strict regulatory framework, that is going to result in identifiable benefits for the consumer.

Web sites of interest

Agrifood Awareness Australia - http://www.afaa.com.au/
Agrifood Awareness Australia, launched in May 1999, is an industry initiative, established to increase public awareness of, and encourage informed debate about, gene technology.

Office of the Gene Technology Regulator -
http://www.health.gov.au/ogtr/index.htm

Gene Technology Australia - http://genetech.csiro.au/
This CSIRO site aims to explain the science of gene technology, and describe what Australian scientists are doing. It also covers some aspects of the public debate on gene technology.

Biotechnology Australia - http://www.biotechnology.gov.au/
Biotechnology Australia was established in the 1999-2000 Commonwealth Budget. It is a multi-departmental Government agency - responsible for coordinating non-regulatory biotechnology issues for the Commonwealth Government, and seeks to

provide balanced and factual information on biotechnology to the Australian community. Choose from the icons to the left to start your biotechnology journey.

Council for Biotechnology Information -
http://www.whybiotech.com/en/default.asp
The Council for Biotechnology Information was founded in April 2000 by leading biotechnology companies to create a comprehensive communication campaign about biotechnology. The council is committed to providing objective, balanced information to help you better understand and appreciate the benefits biotechnology offers, as well as to encourage informed debate about the issues it raises.

AgNet - http://www.plant.uoguelph.ca/safefood/archives/agnet-archives.htm
A searchable archive of articles from around the world on agbiotech. The information is culled from journalistic and scientific sources around the world and condensed into short items or stories that are distributed daily by electronic mail to thousands of individuals from academia, industry, government, the farm community, journalism and the public at large and stored in the archive.
To subscribe to Agnet, send an email to:
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leave subject line blank
in the body of the message type:
subscribe agnet-L firstname lastname (i.e. subscribe agnet-L Joe Bloggs)

Attachments

Attachment 1: From Biotechnology Australia - *Gene Technology: What will it mean for Australia's farmers?* (CSIRO Plant Industry Communications Unit.) 5 pages. NOTE** This article written prior to the establishment of the Office of the Gene Technology Regulator and refers to is predecessor organisation, the Genetic Manipulation Advisory Committee.

Attachment 2: Articles relating to biotechnology

Attachment 3: Statement on Agricultural Biotechnology (from the USA)

Attachment 4: Abridgment of the Summary of the ABARE publication 'Genetically modified grains - Market implications for Australian grain growers'.