

## Genetic Engineering: Is Perception Reality?®

Howard J. Bezar

Crop & Food Research, Private Bag 4704, Christchurch

### INTRODUCTION

A decision on whether to import or release a genetically modified (GM) plant, animal, medicine, or other product is ultimately a political decision, rather than a technical one. Politicians make the final decision, not scientists (Wilkinson et al, 1996). Since part of the decision-making process of politicians involves considering public opinion, public perceptions of the technology and its benefits and hazards have a real influence on the decision. These perceptions may not be in accordance with scientists' understanding and knowledge of the technology but, to all of us, our own perceptions — whatever their basis — are real.

### LIVING WITH RISK

Life is a risk and with every new technology there is a risk. You buy an electric appliance without thinking about the risk, but it could electrocute you or burn the house down. Experts measure risk strictly in terms of known rates of death and disease. The public views risk with a much wider perspective; factors which influence this view include emotional, spiritual, and cultural/political factors. Psychologists have shown that risk assessment of technology by experts and risk perception of technology by the public vary widely. For example, studies have shown that most people believe nuclear power to be one of the riskiest technologies, but experts say the facts reveal that electric power is far riskier and the greatest risk in life is traveling in a motor vehicle. Why the huge difference between risk perception and risk assessment? A major part is explained by what are often known as the “outrage factors” (Boulter, 1997).

### THE “OUTRAGE FACTORS”

These are the subconscious “emotional” factors, which affect our perception of risk.

**Voluntary Risk.** People find voluntary risks are more acceptable than nonvoluntary risks. Genetically modified organisms (GMOs) are perceived as nonvoluntary because the individual was not consulted about their introduction.

**Controlled Risk.** Individuals and communities like to have control over their lives and the power to make decisions. Risks not under individual or community control are seen as threatening.

**Known Risk.** The level of understanding, the extent to which experts agree and the degree of trust in experts, are all factors which affect how much confidence we have in our knowledge of GMOs.

**Memorable Risk** A memorable event, such as an environmental escape like rabbit calici virus, makes a greater impact than a routine release for biological control. Jurassic Park and Frankenstein are memorable too!

**Familiar Risks.** We are inclined to underestimate old risks, such as eating food exposed to bacterial contamination, and overestimate new risks such as GMOs.

**Dreaded Risks.** Some people develop a dread of certain situations as a result of an unpleasant personal experience. These may involve strong negative connotations when linked with new ideas or thoughts.

**Positive and Negative.** The negative will always outweigh the positive.

## THE ETHICAL FACTORS

On top of the wide range of "outrage factors" there are another set of considerations. Moral and ethical values influence peoples attitudes to GMOs.

**Naturalness.** There is a strong belief in nature, a strong stewardship ethic and concern about "tampering with nature". At its simplest there is a belief that all that is natural is good and all that is unnatural is bad.

**Autonomy.** The right of the individual to make choices about their own lives is a strong value held by many people.

**Spirituality.** A common belief is that life is more than a mere collection of chemicals.

**Justice.** People are concerned if they feel the risks are not balanced by benefits. Who gets the benefit? Who bears the risk?

## THE POLITICAL FACTORS

Our cultural and political beliefs also have a big influence on our perception of risk. They mean an individual's frame of reference is not open to frank discussion or acceptance of ideas.

**Conspiracies.** Will vast and sinister conspiracies undermine and destroy our way of life?

**Capitalism and Profit.** Are the proponents of biotechnology putting profit before safety?

**Multinational Power.** Are multinational companies in it for sheer greed and power?

**Globalisation/Free Trade.** Does international trade benefit the big and powerful and disadvantage the small and local?

**Consumer Power.** Does consumer group activism accurately reflect consumer attitudes?

## MEASURING CONSUMER PERCEPTIONS

Scientific social and psychological research in this area greatly helps us to understand and measure public perceptions. However, often this research is confused with superficial public opinion and market research studies that ask simple questions and base broad interpretations on the answers. This principle is well illustrated by the New Zealand portion of the 18 nation Eurobarometer (Macer, 1998) biotechnology poll in 1997. In answer to the first question in the poll, "Do you think genetic engineering (GE) will improve our way of life in the next 20 years?" 39% of the public said it would make things worse, while 32% said it would make things better. From this result you might very well speculate that New Zealanders are split down the middle on this issue. But what does the question really mean?

Could you deduce anything from a similar question, “Do you think rugby will improve our way of life in the next 20 years?” Clearly such a question elicits only a general attitude.

When we probe a little more deeply, the rather negative perception voiced above, suddenly changes and becomes more positive. For example, 64% of New Zealanders support genetic engineering of crop plants if it is used to improve resistance to pests and diseases. Also 49% would encourage the use of modern biotechnology to improve foods and drinks, while 43% would not. These questions provide more useful answers because they ask the respondent to weigh up a specific and realistic application of the technology, a specific instance of benefit and risk.

This result illustrates that New Zealanders don't necessarily object to the process of genetic engineering. They may approve of some applications of the technology (products) but not others. This product verses process argument is at the heart of the debate on labeling of GMOs. Do you label all products of the genetic engineering process even if there is no measurable difference, or do you label on a case-by-case basis if there is a significant difference that consumers might like to be aware of?

## KEY PERCEPTION DRIVERS

**The Power of Personal Benefit.** If we perceive high personal benefit, then risks become acceptable. Perceived benefit is one of the most important factors of choice (Frewer et al., 1997). If the products clearly benefit the consumer, the perception of risk will be low. Research shows and observation confirms that, if the product benefit is seen as being strongly in favour of someone else, for example the farmer or the processor in the case of the Roundup Ready™ (glyphosphate-resistant) soybean, then the perception will be negative. This also explains why the many genetically modified medicines currently being sold in New Zealand don't cause even a ripple of adverse public opinion. Clearly the benefit of a potential cure outweighs any potential risk.

**Trust.** Trust is a critical factor in developing perceptions (Frewer et al., 1997). Who can we trust to provide us with accurate information? The Eurobarometer tells us that New Zealanders place most trust in academics in universities and Crown Research Institutes (CRIs) (54%), followed by consumer organisations (47%) and environmental organisations (23%) to provide accurate information on genetic engineering. Interestingly when asked who is most trusted to regulate genetic engineering, parliament feature very low (14%) while international organisations (62%), scientific organisations (40%), and ethics committees (38%) share significantly more public trust as regulators of the technology.

**Credibility.** Accuracy, balance, and effective communication will ultimately win trust but this is difficult because of the high-tech nature of GMO/genetic technology which can't be seen with the human eye. The credibility of sources, concurrence by other scientists and/or experts, the use of primary peer-reviewed information rather than secondary information, and acknowledgement of alternative views is critical. The history of the genetic engineering debate shows that factual information can easily become a half-truth, or worse an urban myth but in the long term accuracy and balance will win. A good example of this is the impact of genetically modified corn pollen on monarch butterflies. This story turned from an “unforeseen disaster” to a “benefit for conservation” once the full facts were effectively communicated.

**Context.** One of the most frequent causes of negative perceptions in food, health, and nutrition issues is the lack of context. When new information is not placed in the context of current or familiar information, it can easily appear alarming or bizarre. In the debate on the genetic engineering of plants and animals, comparisons with current genetic manipulation, current agricultural and food processing technologies, and consumer perceptions of other food hazards, are all very important.

### **A UNIQUE OPPORTUNITY FOR DEBATE: THE ROYAL COMMISSION ON GENETIC MODIFICATION**

New Zealand's approach to resolve the diverse views of the public on this critical science question was to establish a Royal Commission on Genetic Modification (RCGM). This is the highest level of public enquiry available within the law and is undertaken independently of parliament, usually headed by a High Court judge. The RCGM is headed by retired Chief Justice, Sir. Thomas Eichelbaum; assisted by Dr. Jacqueline Allan, a general practitioner with strong Maori affiliations; Dr. Jean Fleming, a scientist; and Bishop Richard Randerson, who has a background in social issues. The Commission's aim was to report on strategic options for New Zealand with regard to genetic modification. Consultation began in August 2000 in a way that allowed both Maori and Pakeha (European descent) New Zealanders to clearly express their views, and the enquiry was inclusive of ethical, cultural, environmental, and scientific perspectives on the use of genetic modification technologies. A huge volume of information is available on the website <[www.gmcommission.govt.nz](http://www.gmcommission.govt.nz)>.

"Interested Person" status was given to 109 organisations. This enabled them to present oral submissions, produce witness evidence in support, and had the right to undertake cross-examination. In addition, more than 11,000 organisations and individuals, many from other parts of the world, made general public submissions through the web-site established by the Royal Commission. Apart from the 53 days of formal hearings, the RCGM participated in public meetings, a youth forum, and workshops for Maori. The major issues that arose during the RCGM graphically illustrate the emotional, ethical, and political factors, which drive public perception.

**The Precautionary Principle.** The precautionary principle debate embodies issues of naturalness, stewardship, risk of the unknown, as well as political issues. To some, the precautionary principle implies that precautions should be taken even if cause and effect has yet to be scientifically established. In other words if there are unsubstantiated fears or hypothetical risks, don't proceed. More realistically the precautionary principle is generally interpreted as that, in the face of scientific uncertainty, one should refrain from actions that might harm the environment or human health, and that the burden of proof is on those who oppose the prohibition.

A basic unresolved question about the precautionary principle concerns the amount of evidence (or lack thereof) needed to invoke it. Some claim also that lack of evidence of harm is not proof of safety, essentially the long-term harm question. Is it a question of "likely harm" or "serious or irreversible harm" which should trigger the principle? The major problem is that extreme precaution precludes any innovation. Thus there is a good case for a precautionary approach, but reference to a "precautionary principle" is confusing.

**Treaty of Waitangi.** The Treaty of Waitangi embodies the rights of our indigenous people in a politically important document. The concerns raised by Maori were

largely ethical. The transfer of genetic material between species compromises whakapapa (genealogy). Allowing genetically modified flora and fauna fails to acknowledge the relationship Maori have with their taonga (treasure), which is protected by the Treaty. Matuatunga (traditional knowledge) should be protected from indiscriminate use by non-Maori. At one end of the opinion spectrum, genetic modification was viewed by some Maori as abhorrent to Maori culture and spirituality and that Maori should have the right to veto the use of the technology in New Zealand. At the other, Maori are seen as bold, outgoing, and adventurous and ready to recognize and adopt new technology that was consistent with their culture.

Opinions within Maori were as diverse as opinions within the Pakeha community. The major cultural issue for the Royal Commission to make recommendations on, will be what constitutes effective consultation with Maori, and how Treaty rights can be resolved when decisions are made on the release of GM products. This can only be done on a case-by-case approach with a decision making framework that allows issues such as freedom of choice, customary values, and proprietary rights to be taken into account.

**Liability Issues.** Liability is essentially an issue of justice. Whose responsibility is it if things go wrong? Of course this is not a new issue so there is considerable legal precedence. Questions were asked about remedies for third parties that may suffer economic loss or damage as a result of pollen or seed dispersal or horizontal gene transfer. Calls have also been made for guarantees of compensation in the event of environmental damage and health effects that arise at some time in the future from unforeseen consequences of activities involving GMOs or GM products. A strong case was made, however, that New Zealand does not need to adopt special legislation for possible loss or damage caused by the use of GMOs. There are already common law actions available under such Acts as the Resource Management Act 1991, the Fair Trading Act 1986, and the Sale of Goods Act 1908

**Medical Applications.** As predicted from an understanding benefit and risk, genetic modification in medical applications were not a major issue. There were however, some Maori and other groups that were reluctant to accept any form of genetic manipulation, because to do so spoils the purity of the argument. Some argued for GM medicines only from bacteria, not from plants or animals. Ethical considerations are important and GM medicines are already considered on a case-by-case basis in the same way as non-GM medicines. Clear views were expressed that preventing research or development of GM medicines or genetic modification techniques because of alleged risks, could be unethical.

**Genetic Modification and Organic Food Production Systems.** It became clear during the RCGM that the outrage factors, ethical issues, and political views all played a part in this issue. Can organic agriculture and genetic modification technology co-exist? A strong view held by organic producer groups is that genetic modification technology is a threat to their preference for a particular process of growing crops and animals; to our "clean green" image overseas; and to the integrity of the certification scheme. Their vision for the whole of New Zealand agriculture being organic by 2020 would require all other growers and agricultural producers to forgo genetically engineered crops so that they can maintain their preferred lifestyle and farming option.

The counter argument was that GM, organic, and conventional agriculture co-exist in the USA, Australia, and Argentina, and is possible in NZ. However, the possibility of cross pollination or seed dispersal cannot be eliminated. Similar issues arise with conventional seed breeding, where the issue is dealt with by management practices and purity thresholds. The same principles should apply to organic and GE-free certification systems. In the USA, as long as an organic operation has not used GM components, and takes reasonable steps to avoid contact with the products of genetic modification, the unintentional presence of the products of genetic modification does not affect the status of an organic certification.

**Genetic Modification and the Economy.** Political views clearly dominated the perception of the economic impact of the technology. Organic groups stated that their preferred economic model for NZ would be to delay commercial release of GM food until the extent of the negative consumer attitude can be seen and the producer benefits become more apparent. Economist Dr. Caroline Saunders, who studied various economic models, predicted that the greatest positive impact for the NZ economy is the GM-free strategy, where it is assumed such markets as the European Union and Japan have a large preference against GM food.

Another Economist Dr. Adolf Stromburgen, commissioned by the Life Sciences Network, agreed with Dr. Saunders that a rejection of genetic modification in favour of organic agriculture would boost the economy. He measured an increase in GDP by 0.7%. However, he believed the gains would be significantly less than scenarios in which GM technologies were adopted.

Most submitters involved in the development of GM technologies argued that there is a significant risk to NZ's economy in adopting a GE free or organic-only approach. They argued that the future success of the biological industries is in applying new ideas and technology, maintaining NZ's cost effectiveness and producing in a sustainable way. They concluded that NZ's strategic economic place as an exporter is to have a range of agricultural options available, including genetic modification.

**Trust and Credibility.** Throughout the RCGM it was frequently alleged that scientists who promote responsible genetic modification are reductionist in their approach to science, are biased because they have been "bought" by business, and that they work without an ethical framework. These allegations were not supported by evidence and, in fact, there was considerable evidence that most of the scientific support for the anti-GM argument came from those who begin with presuppositions, based on a political, religious, or values positions, and "fit" the science into that perspective. The worst example was one of the leading overseas witnesses called by the Green Party who was found to have given evidence which cited papers that didn't exist and applications to a government regulatory authority for which there was no record. Clearly the balance of scientific evidence was overwhelmingly in favour of GM technologies and most of the evidence from a scientific perspective opposing GM is not of sufficient scientific reliability and credibility to give rise to scientific uncertainty.

**Where Does New Zealand Draw the Line?** The central question the RCGM is challenged to advise Government on is essentially to answer the question — Where does New Zealand draw the line? The social activist community wanted an outright ban because genetic modification is the latest attempt by multinational corporations and first world governments to exploit the third world. Most believed the benefits

claimed are false; that patenting GM products and technology will further transfer power and wealth from indigenous peoples to multinational corporations; and that all products of genetic modification should be labeled to enable people to choose to avoid them. This view was generally agreed by the environmental activist community, for whom genetic modification poses unacceptable risk to the environment through unknown effects that may only become apparent on an evolutionary time scale.

Perhaps surprisingly the religious community generally agreed that the science of genetic modification is not inherently ethical or unethical, but that balancing competing interests and values requires a more structured process of ethical guidance and decision-making that is not readily apparent at the moment.

The proponents of genetic modification argued that the technology is vital for New Zealand's future economic, social, health, and environmental status. They see it as critical for educators, scientists, growers, marketers, and developers to be able to continue to research and develop products and solutions using genetic modification responsibly. They support regulations that protect the public interest whilst not acting as barriers to development. The messages were clearly: have minimal barriers to moving forward with appropriate caution; make decisions on a case-by-case basis, taking into account cultural, spiritual, environmental and values concerns; always base decisions on sound science and a consideration of economic impacts.

## CONCLUSION

Is perception reality? In the political world the answer is all too frequently — yes. In the science world, perceptions are well understood to be transient and not necessarily based on tested evidence. While ultimately the decision on where to draw the line will be a political one made by parliament, I am sufficiently optimistic to believe that science will be the major determinant of that final decision.

Genetic engineering needs to be explained, not promoted. The issue is not about persuading people to accept the technology because scientists say it's safe. The issue is about trusted sources, giving accurate information, on a case-by-case basis, and allowing consumers to make informed choices. Enduring attitudes will be formed over time and the challenge is to supply quality information and ensure that consumer safety is paramount.

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