Studies in Innovation and Change

Public Understandings of Biotechnology in New Zealand: Nature, Clean Green Image and Spirituality

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Contents

LIST OF TABLES ..... **V**

PREFACE ..... **VII**

ACKNOWLEDGEMENTS ..... **IX**

SUMMARY ..... **XI**

CHAPTER 1 BIOTECHNOLOGY IN NEW ZEALAND: ISSUES AND CHALLENGES **1**

1.1 Biotechnology 1
1.2 Context of the Study 2
1.3 Regulating Biotechnology in New Zealand 3
1.4 The Public Imagination: Influential Introductions to Biotechnology 4
1.5 Other Issues that Influence the Biotechnology Debate 8
1.6 Summary 9

CHAPTER 2 THEORETICAL PERSPECTIVES ON BIOTECHNOLOGY **11**

2.1 Introduction 11
2.2 International Perspectives on Risk Perception 11
2.3 National Studies on Biotechnology 17
2.4 The PABE Report 21
2.5 Summary 24

CHAPTER 3 APPROACH TO THE FOCUS GROUP RESEARCH **27**

3.1 Introduction 27
3.2 Situated Knowledges 27
3.3 Focus Group Methodology – A Rationale 28
3.4 Recruitment 31
3.5 Research subjects/locales 31
3.6 Demographic Data 31
3.7 Application of the Focus Group Method 37
3.8 A Reflective Critique 39
3.9 Data Analysis 40

CHAPTER 4 BIOTECHNOLOGY ISSUES AND MEANINGS **41**

4.1 Introduction 41
4.2 Contemporary Issues Relating to Biotechnology in New Zealand 41
4.3 Meanings of Biotechnology 49
4.4 Uniformity and Difference 55
4.5 Summary 56

CHAPTER 5 NATURE, CLEAN GREEN NEW ZEALAND AND SPIRITUAL VALUES **59**

5.1 Introduction 59
5.2 Nature/Natures 59
5.3 New Zealand's Clean Green Image 73
5.4 Spirituality 78
5.5 Summary 84

CHAPTER 6 DISCUSSION AND CONCLUSION 87

6.1 Introduction 87
6.2 Overall Summary of Results 87
6.3 Discussion of Results 90
6.4 Implications for Policy 96
6.5 Limitations of Current Study and Further Research 97

REFERENCES 99

APPENDIX 1 DEMOGRAPHIC SURVEY 103

APPENDIX 2 PHASE 1: FOCUS GROUP GUIDE 105

APPENDIX 3 FOCUS GROUP GUIDE – PHASE II 113

APPENDIX 4 BIOTECHNOLOGY CARTOONS 117

APPENDIX 5 THE HUMAN MILK-MACHINE 119

List of Tables

Table 1 Age category 32
Table 2 Gender 32
Table 3 Marital Status 32
Table 4 Numbers of Children 33
Table 5 Nationalities 33
Table 6 Ethnicity 34
Table 7 Country of Birth 34
Table 8 Employment Status 35
Table 9 Occupational Categories 36
Table 10 Personal Income Categories 36
Table 11 Highest Level of Education 37

Preface

Biotechnology is the use of living organisms to make products and solve problems. In New Zealand, its has made national headlines through public controversies over genetically modified corn, cloned sheep and the transplantation of animal cells into human bodies. Whilst scientists and government bodies make decisions regarding the applicability and ethical standards of such research, the public are sometimes not given full attention in this decision-making process. This report presents the findings of a series of focus groups across New Zealand that concentrated on public perceptions of novel biotechnologies. It focuses specifically on the role of nature, 'clean green' image and spirituality in determining the acceptability of a series of recent innovations. A parallel report focuses on how and why focus group members ranked five selected biotechnologies.

Professor Caroline Saunders

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Summary

- Focus groups explored public attitudes and values about the use of new biotechnologies in New Zealand. These groups spanned the whole of New Zealand and emphasised the acceptability of specific examples of new medical, agricultural and environmental biotechnologies, and the reasons underlying this.

- The report builds on previous work by researchers in related sub-disciplines, particularly the European Commission's PABE report. This report has a particular focus upon the role of nature, New Zealand's 'clean green' image and spirituality in the perception of novel biotechnologies. These are areas that have been little explored in the current literature, but which are relevant when applied to perceptions of biotechnology in New Zealand.

- Biotechnology was conceived by focus group participants, as a 'secret science', characterised by laboratory work that took place behind closed doors. It was frequently equated with the term, genetic engineering, and a small number of people could not accurately define it. In the public arena, the term was not part of everyday talk, and less of a concern than more basic issues such as access to primary health care, housing, employment and education.

- Focus group participants were influenced in their perceptions of biotechnology by a series of underlying attitudes and values that included ethical and moral issues, spirituality, perceptions of nature, personal control, interpersonal connections and national identity. These were not influential in isolation, but interacted with one another in complex ways when it came to making decisions about particular aspects of biotechnology.

- The word 'nature' was found to be fundamentally important, referring to competing/overlapping versions of nature as wise, dynamic, competitive, traditional, human and balanced. These conceptions were applied in specific contexts and used to either refute or support the use of novel biotechnologies in New Zealand.

- New Zealand's clean green image was seen as a national icon, but one that existed either in the past or was a future utopia that participants strived to reach. This utopia could either be accomplished by steering away from agricultural and environmental genetic engineering or by using it to sweep up the remnants of past mistakes such as pesticide contamination.

- The absence of references to spirituality was revealing in itself, suggesting that New Zealanders feel uncomfortable discussing this issue in public. However, among Christians in the focus groups, specific biblical codes of ethics were cited in relationship to their receptivity towards new biotechnologies.

- The overall results of this research are discussed in terms of their ethical implications. We connect them to recent literature that emphasises the need for an inter-relational hybrid ethics, in an era where the autonomous human subject has been destabilised and theoretically superseded by a world of inter-subjectivity between human and non-human nature.

Chapter 1
Biotechnology in New Zealand: Issues and Challenges

1.1 Biotechnology

The term 'biotechnology', resonates with a sense of newness and novelty, but actually refers to an age-old process. Commonly associated with genetic engineering, biotechnology actually has a more diverse history that spans the broad expanse of space and time. Although the term was not officially coined until 1917 (IBAC, 1999:2), biotechnology has been used for a lengthy time period and includes traditional processes such as fermentation for beer production, bread making and animal and plant breeding techniques. More recently, the category of genetic engineering has joined the ranks of biotechnology applications, but the two terms are not mutually exclusive. Other examples include DNA testing, cloning, 'pharming', xenotransplantation and more recently, in allegiance with computer science, the production of 'biosensors', where inanimate objects are endowed with the sensory apparatus of living organisms. More specifically, some international definitions of biotechnology are listed below.

> Biotechnology is a set of scientific tools, which uses living things to solve problems and make products.
> *Independent Biotechnology Advisory Council (1999:2)*

> Biotechnology uses living organisms to create new products that improve the quality of our food, our health and our environment.
> *Canadian Institute of Biotechnology*

> [Biotechnology is] any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.
> *United Nations Convention on Biological Diversity*

Definitions of biotechnology range from the broad to the specific, historical to contemporary, but all focus upon the manipulation of living organisms to make products or enhance processes. This theme is picked up in the official definition used by the New Zealand government.

> Biotechnology is a broad term for a group of technologies that are based on applying biological processes. It involves the use of living things or their derivatives to solve problems and make products.
> *Ministry of Research, Science and Technology*

In this particular study, we have closely aligned with the current definition espoused by the New Zealand Ministry of Research, Science and Technology. Note that this definition almost parallels that of the UN Convention on Biological Diversity, quoted above.

1.2 Context of the Study

This programme was granted funding in response to a demand for additional information on public perceptions of the risks of biotechnology. The Foundaton for Research, Science and Technology identified the need for research into the key socio-economic impacts of biotechnology. More specifically, the Foundation recognized how important it was to identify the relevant factors in determining the public perceptions of technological risk. These factors are associated with the full range of biotechnologies including medical, environmental and food applications. The public perception of technological risk is of critical importance in the future development of biotechnology in New Zealand. Consequently, there is a need for tools to assist in the analysis of perceived technological risk.

The aim of this programme, entitled 'The Fate of Biotechnology. Why do the public reject novel biotechnologies?', is to improve decision-making, policy-making and communication by key government agencies and science providers regarding the development and application of biotechnology in New Zealand. More specifically, the objectives of the overall programme are to:

- Identify perceived effects of biotechnology and document the perception of risks associated with personal and general use of biotechnology.
- Determine the relative importance of the key perceptions of risks.
- Determine the social and cultural factors that underlie the identified risk perceptions, including international comparisons.
- Model the trade impacts of various scenarios of risk perception relating to new technology uptake.
- Synthesise results into a socio-economic risk-assessment decision aid in order to assist end user decision making and communication.

Phase one of the research focuses on the first three objectives. As a result, this project assesses the public perception of the risks involved with new agricultural, environmental and medical biotechnologies. During a series of eleven focus groups of ten to twelve people each, participants were asked to discuss their perceptions of the impacts of pertinent examples of biotechnologies such as genetically modified organisms, cloning, xenotransplantation and stem cell research.

The information gleaned from the objectives addressed in this report study will be combined with results from other objectives to improve decision-making, policy-making and communication by key government agencies, with regards to the development and application of biotechnology in New Zealand. This outcome will lead to the benefits to New Zealand of an improved understanding of social and community issues surrounding new technological advances. It will also lead to the development of a risk assessment model that addresses New Zealand-specific concerns and will provide underpinning knowledge and information in order to contribute to effective regulatory systems.

But what are the New Zealand-specific concerns? They can be divided into issues of how the government regulates biotechnology and public responses to biotechnology. These are summarized below to provide a context for the focus group results.

1.3 Regulating Biotechnology in New Zealand

A need for the international regulation of biotechnology began in 1973 when the molecular structure of DNA was identified and published. By the early 1970s researchers could see "how DNA could be cut and spliced between species" (Report of Royal Commission on Genetic Modification (RRCGM), 2001:104). In 1974 scientists in the U.S.A. called for a moratorium on such experiments and in 1975 they met in Asilomar and developed a set of guidelines for working with bacteria and "voluntarily regulated their own activity" (ibid.).

In the same year the New Zealand Medical Research Council (MRC) drafted guidelines for all research it funded. In 1977, these guidelines were expanded, and followed by all other Government departments (e.g., DSIR, MAF). By 1978 the Government had developed recommendations that all institutions were responsible for the appointment of biological safety committees and officers to decide on proposed experiments on the basis of laboratory suitability and risk. A moratorium on field release was instituted in 1978. In 1982 the jurisdiction of these committees was limited to the approval of low risk experiments and others were referred to a cabinet-appointed advisory committee. In 1987 the Ministry for the Environment was required to assess all proposed releases of genetically modified organisms, and in 1988 the moratorium on field trials was lifted as the Government was moving towards the development of the Hazardous Substances and New Organisms (HSNO) Act 1996 (ibid.: 104-5).

The purpose of this Act was "to protect the health and safety of people and communities by preventing or managing the adverse effects of hazardous substances and new organisms" (ibid.: 112). HSNO specifies different levels of containment for research of differing risk, meaning that laboratories can be categorised by different levels of security. However, this is more difficult for larger organisms such as sheep or cows and experiments on animals can be categorised as "contained" but still be carried out in the field with particular controls (ibid.: 112-3).

One further piece of government legislation is the 1993 Biosecurity Act that covers ways of excluding, eradicating or managing unwanted pests and organisms (ibid.: 114).

1.3.1 Regulatory and Ethical Bodies

A number of institutions have been developed to aid with the regulation of biotechnology in New Zealand.

- The Environmental Risk Management Authority (ERMA) was established under HSNO and is responsible for giving approval for any importing, developing, field-testing or release of genetically modified organisms.

- Whilst ERMA manages the entry of new organisms, the Ministry of Agriculture and Forestry (MAF) supervises border control and quarantine issue.

- The Australia New Zealand Food Authority (ANZFA) and ERMA notify each other and exchange information about genetically modified food or ingredients. They try to coordinate approvals for the release of genetically modified (GM) foods and other related biotechnologies. The Department of Conservation (DoC) is also given priority in submissions on new organisms.

- The Health Research Council (HRC), the major Government funded agency for coordinating and funding health research, has a committee responsible for the validity and safety of clinical trials, which are only approved if they have been earlier approved by ethics committees which are accredited by its ethics committee.

Under the Animal Welfare Act 1999 institutional ethics committees review all funding applications involving animals or animal tissue (ibid..:114-6).

1.3.2 Royal Commission on Genetic Modification

In 2000, the New Zealand government established a Royal Commission on Genetic Modification, which consulted widely with national residents and received their submissions. The report of this commission was published in 2001 and found that New Zealanders were most comfortable with genetic modification for medical purposes, but were uncomfortable with its use in food, feeling that "the safety and certainty of the science have yet to be proved" (ibid.:2). Concluding this report was the statement, "New Zealand should keep its options open" and "proceed carefully, minimising and managing risks". Furthermore, the Commissioners wanted to see the "coexistence of all forms of agriculture" (ibid.).

The Commissioners thought that it was difficult for the regulatory authorities ERMA and ANZFA to address issues of cultural values and recommended the establishment of Poi te Taiao (the Bioethics Council) to debate such matters. They also felt that New Zealand should develop a biotechnology strategy, which was published in Autumn 2003.

The basic regulatory frameworks of ERMA and ANZFA were found to be appropriate for New Zealand, but the Commissioners wanted to add a new category of 'conditional release' in which a genetically modified organism could be released from containment but would still be subject to continuous "reporting-back" procedures (ibid.:2-3).

1.4 The Public Imagination: Influential Introductions to Biotechnology

Over the past 15 years, specific concerns surrounding biotechnology and research have featured in the public media. These issues have been both international and local and often an international event has precipitated public interest in a local biotechnology development. This section summarises some of the most influential of these issues.

1.4.1 Transgenic Sheep

Perhaps because of New Zealand's strong association with sheep, Dolly, the first mammal cloned in 1996, from an adult stem cell, by the Scotland based firm PPL Therapeutics, gained wide press coverage in New Zealand. Many people would also be familiar with Dolly's early demise after suffering from the effects of premature aging such as a progressive lung disease and arthritis (RSNZ News, 15 Feb. 2003). In response to this initial step, New Zealand scientists cloned their first sheep in 1997 at the Ruakura campus of AgResearch in Hamilton (RSNZ News, 15 March 1997).

This interest was picked up in 1998 when the same company, PPL therapeutics, sought permission to breed 'milking' sheep, which were genetically modified. Human genetic material had been introduced to these sheep, to enable the production of milk with a human protein that might be used to treat emphysema, cystic fibrosis, and atopic dermatitis. This

continuing saga is one that also illustrates the many variations of one story that can develop through media communication.

At this stage PPL Therapeutics had already bred 40 to 50 transgenic rams, which were held in containment. They had been born under permission obtained from "the Environment Ministry's interim assessment group in 1996" (RSNZ News, 9 Dec. 1998). In contrast a later report (RSNZ News, 11 Dec. 1998) said that the sheep would be produced from semen imported from Scotland. The ERMA statement released at the time the application was granted (23 March, 1999) stated that a number of these New Zealand sheep were taken to Scotland for breeding purposes. Semen from a ram in this flock was imported back into New Zealand and would be used to produce two flocks of up to 5,000 milking ewes in the future.

New Zealand sheep, and New Zealand as a country, were chosen for this research and production because New Zealand is known to be free of diseases such as mad cow disease and scrapie. There is a concern that these diseases may be passed on to humans from animals. However, at the time this application was successful the Maori Advisory Committee commented, "some Maori found insertion of human genetic material into other species offensive and abhorrent …" (RSNZ News, 20 June 2003).

In 1995, the first application for approval was refused. This was believed to be because "public concern about genetically modified organisms could close down a large chunk of New Zealand research if we didn't get a proper public understanding and good quality risk-management procedures in place, to reassure people" (Simon Upton, Environment Minister in 1995, RSNZ News, 22 June 2003).

More recent developments have illustrated another risk involved in the growth of commercially based biotechnology. PPL Therapeutics has become financially troubled and has decided to discontinue this research programme (RSNZ News, 23 June 2003). Its parent company, Bayer Biological Products, has decided to focus on a rival drug treatment for the same condition (RSNZ News, 19 June 2003). This has raised concerns about the possibility that the disposal of these sheep (up to three thousand) may mean they end up in the food chain in some way or other. In response, ERMA stated that there were strict enough controls in place for this not to happen (The Press, 23 June 2003) and the Environmental Minister said that MAF and ERMA would ensure that regulatory conditions were complied with (RSNZ News, 25 June 2003).

However, due to seemingly contradictory information, a number of questions remain unanswered. Were these sheep cloned and/or transgenic? How many are there at present? One report stated that PPL was going to milk cloned ewes later this year (RSNZ News, 24 June 2003). In 1997 it was noted that a researcher was "collecting cells from lambs to establish a cell line … for cloning whole flocks of sheep" (RSNZ News, 22 June 2003(1)). The press release from ERMA at the time the application was successful (23 March 1999) said that cloning was not involved. According to differing reports there were more than 2,000 sheep (Radio NZ News, 23 June 2003), less than 3,000 (TV One News, 6pm, 23 June 2003), of which 1,000 – 4,000 are transgenic (RSNZ News 24 June 2003) and so on.

There were also contradictory views about the relative success of this treatment. Robert Mann said that medical trials had shown limited success (RSNZ News, 22 June 2003(1) and 11 Dec. 1998). However, Jeanette Fitzsimmons, co-leader of the Green Party more tersely noted that it was "poor science" that "put the cart before the horse" (RSNZ News, 22 June 2003(2)). The Maori Advisory Committee felt that such a treatment would be too expensive to be used widely and would be unlikely to be used by indigenous people, and that the

incidence of cystic fibrosis was too low for it to be of great help to humankind (RSNZ News, 22 June 2003(1)).

1.4.2 Monarch Butterflies and GE Corn

Headlines such as "Greenpeace urges watchdog to reject butterfly-killing GE maize" (RSNZ News, 10 August 1999) led to fears that Bt corn, genetically engineered to produce its own insect control, was killing the larvae of monarch butterflies. The larvae fed on milkweed plants found in the cornfields of the mid-western U.S.A.; plants that studies claimed were contaminated by Bt pollen (RSNZ News, 20 May 1999). This argument was used to dampen an application to grow GE maize in New Zealand to supply seed to France. "About 12 protestors gathered outside the hearing … wearing monarch butterfly wings and handing out leaflets criticising the genetic modification of food" (RSNZ News, 10 August 1999). However, "the application was approved subject to strict containment conditions …" (RSNZ News, 23 September 1999). Later, these fears were allayed by further research, which showed flaws in the initial laboratory studies that had used ground-up corn, as well as pollen to feed larvae (RSNZ News, 10 September 2001). Further research suggested subsequent risk was posed to the Monarchs by the anthers of the cornflower (RSNZ News, 13 September 2001).

1.4.3 'Corngate'

In the week prior to the General Election in July 2002, Nicky Hager's book, "Seeds of Distrust", was published by a Green Party candidate, Craig Potton. Hager claimed that some GE corn had been planted in the Hawkes Bay region, and that this had been covered up by the Government. The parallels to the US-based "Watergate" scandal and President Nixon's impeachment led to the dubbing of this incident, "Corngate". Apparently, seed certified as GE-free had been planted and seed from the crop had been sold, mainly to the European Union (RSNZ News, 11 July 2002).

In the ensuing period many different scientists and the Minister of Science, Research and Technology took the opportunity to try to explain and educate the general public via the television, radio and press media, in the complexities of risk management and the measurement of GE contamination of seed. An inquiry into the Government's actions at the time of the alleged discovery, started in February 2003. It has still not been officially decided whether the seed was contaminated or not.

1.4.4 Potatoes and Toads

In September 1998, the Green Party announced Crop and Food Research's intention to try to make potatoes resistant to soft rot bacteria by introducing DNA from toads (RSNZ News, 27 Sept. 1998) via an existing soil bacterium (RSNZ News, 12 Nov. 1998). It was also made clear later by the chief researcher, Dr. Tony Conner, that "the genes used were not actually from toads or silkworm larvae. Rather, they were similar, artificial genes" (RSNZ News, 11 March 1999). Approval for trials was given by ERMA in late December, 1998 ((RSNZ News, 24 Dec. 1998). It was these potatoes that featured in the national news in March 1999 when the research trial was destroyed by a group calling itself the 'Wild Greens', a wing of the Green Party. However, by sabotaging the trial, its containment conditions were actually breached (RSNZ News, 11 March. 1999). In January 2002, there was a similar destruction of potatoes growing in a greenhouse at Crop and Food Research at Lincoln (RSNZ News, 11 Jan. 2002).

Interestingly, at the time these trials were approved there was a similar application for the use of DNA from the silk worm to make potatoes resistant to tuber moth larvae has not received the same publicity.

1.4.5 Xenotransplantation

Xenotransplantation is the transplantation of living animal tissue into humans. Researchers hoped that organs from animals could be transplanted into humans because there was such a shortage of human donors (RSNZ News, 24 August 2000, 12 April 2002). In 1996 a company, Diatranz, placed insulin producing pig cells into six diabetics in New Zealand (RSNZ News, 28 March 2002). Their hope was that this process would lessen the need for insulin, which controls blood sugar levels. In March, 1997, the Ministry of Health (N.Z.) placed a moratorium on xenotransplantation because "nobody really knows what the implications are." There was a fear that viruses from animals could be passed on to harmful humans by xenotransplantation (RSNZ News, 21 March 1997). Such retroviruses could cause illnesses such as cancer (RSNZ News, 24 August 2000), HIV and BSE.

In 1999 and in 2001 Diatranz had its applications to transplant live pig tissue into humans refused by the Ministry of Health (RSNZ News, 13 July 2001). Diantranz's medical director said that, "The process … was no more genetic tampering than an average blood transfusion." He continued, "We'll just have to look at moving the rest of the research overseas, as we can't go on forever and this is a ridiculous attitude that's been taken. People want us to ride this knowledge wave but when you go surfing you take a few risks whatsoever, the wave is going to pass you by. New Zealand hasn't got a hope of getting out of the mess it is in …" (RSNZ News, 7 August 2001). Later in 2001, it was reported that a combined New Zealand and Mexican team demonstrated that this technique was successful on 12 insulin dependent diabetics (RSNZ News, 15 October 2001) and that one teenager in the trial has gone off insulin injections altogether (RSNZ News, 18 March 2002).

In December 2001, the New Zealand government moved to add to the HSNO Amendment Bill a motion to constrain the use of xenotransplantation and genetic engineering of a human embryo until June 2003 (RSNZ News, 20 Dec. 2001). In March 2002 they became further concerned when the Cook Islands government appeared supportive of having the Diatranz trials in their country. The New Zealand government was concerned about the flow of disease between the two countries due to the constant exchange of people (RSNZ News, 5 March 2002). In late March 2002, Diatranz appealed against the earlier decision and the Cook Islands government deferred their decision. (RSNZ News, 28 March, 2002). In April, 2002 the Cook Island's government was briefed by the New Zealand government on why it had not approved the trials, and there the matter stands at present.

1.4.6 Using Stem Cells and Embryos for Research

Embryonic stem cells have the ability to grow into any kind of tissue in the human body. The main issue for scientists is to learn how to guide them to develop in specific ways. For examples, these cells have the potential for treating Parkinson's and Alzheimer's Diseases or diabetes by forming insulin-producing pancreatic cells, brain cells, and heart and other muscle cells. Stem cells taken from adults are believed to be less flexible and are consequently less useful in potential medical treatments (RSNZ News, 10 August 2001).

Many countries have developed guidelines for stem cell research. For example, in Canada, scientists can use embryos left over from infertility treatment or abortions, whereas in the U.S.A. scientists are only allowed to work with existing stem cell lines. Great Britain allows

the cloning of embryos specifically for research. In New Zealand the HSNO Amendment Bill has had an addition that restricts germ cell line gene therapy – the genetic engineering of eggs, sperm or early embryos so that altered genes can be passed on to future generations (RSNZ News, 20 Dec. 2001), but so far it has no legislation about research using stem cells.

Two researchers at the Faculty of Medical and Health Sciences, University of Auckland, Richard Faull and Bronwyn Connor, are studying whether stem cells can be removed from a patient and regenerated in some way, then returned to the same person. As a viable alternative to the use of embryonic stem cells, this technique may help sufferers from Alzheimer's and other brain diseases, and spinal chord injuries (University of Auckland, 2003).

One of the British scientists who helped clone Dolly has said that he plans to create new stem cell lines from 40 to 100 embryos from fertility clinics by the end of 2003, for use in his own research, but also to go into the marketplace. He is based in Singapore with the company ES Cell International (RSNZ News, 31 October, 2002).

1.5 Other Issues that Influence the Biotechnology Debate

A number of incidents unrelated to biotechnology have further influenced the development of policy and thinking about biotechnologies. These include the issue of informed consent, the storage of hearts at Green Lane hospital and livestock as the primary producer of greenhouse gases.

Firstly, the issue of 'informed' consent has had wide coverage in the New Zealand press since 1987, when Sandra Coney and Phillida Bunkle wrote a magazine article titled 'The Unfortunate Experiment'. This told the story of 'Ruth' (a pseudonym) who had unknowingly been part of an experiment on the treatment of cervical cancer, started at the National Women's Hospital in Auckland in 1996 by G.H. Green (Coney, 1993:10; Coney, 1988). As a result of this experiment many women died because they had not received the treatment, which could have saved their lives. This led to a Government sponsored inquiry and the resultant Cartwright Report (1988) (as it has become known) made many recommendations including a tightening up of informed consent procedures. Following this was the National Cervical Screening Programme, which has had problems since its inception and frequently features in the news.

Secondly, hearts retained from post mortems of babies and children were kept for research purposes at Green Lane Hospital since 1950. Parental or caregiver consent was never given because it was not seen as an issue (RSNZ News, 27 Fe. 2002). When this was discovered in 2002, it caused such a furore that the hospital went to great lengths to return them to surviving relatives, many of whom may not have know the hearts were removed in the first place.

Finally, the New Zealand Government has made a commitment to the Kyoto protocol to lower New Zealand's contribution to greenhouse gases. As a result the Government announced in June 2003 that it would levy farmers nine cents per sheep and 72 cents for cattle processed at meat works. Milk solids will also be levied to cover dairy cattle emissions. This money would contribute to research on how to lower green house gases. Other industries will be taxed for emissions in 2007.

Farmers are not happy about this proposal. They argue that rural New Zealanders will be meeting the cost of something that should be paid for by all New Zealanders and everyone

would be affected (RSNZ News, 19&24 June 2003). Farmers have threatened civil disobedience if the Government does not change its policy (RSNZ News, 7 July 2003).

These three issues of informed consent, the storage of hearts and the nation's responsibility for cutting down greenhouse gas emissions have all sensitised the New Zealand public to research issues in general, and to some extent have reduced the level of trust in science and scientists. Consequently, there is heightened sensitivity to biotechnology issues.

1.6 Summary

Biotechnology has been around for a long time and refers to the use of living organisms to make products or solve problems. Most recently, media coverage of new biotechnologies alerted New Zealanders to issues about their relative safety and the regulatory procedures surrounding their containment. Examples included xenotransplantation, the 'Corngate' incident, transgenic and cloned sheep, Monarch butterflies and GM corn, embryonic stem cell research, and the infamous '*toad potatoes*'. In New Zealand, some regulations are well-established, but others, such as guidelines about stem cell research, are in need of development. Some other issues not directly related to biotechnology have increased sensitivity to biotechnology developments in New Zealand.

Our objectives in this study were to examine public perceptions of the impacts and risks of biotechnology in New Zealand, determine the relative importance of these risks, and determine the underlying attitudes and values that underpinned these risk perceptions. Using the focus group technique, we drew upon some of the cited examples of public interest, and transformed them into exemplars that were nationally relevant to participants. This report presents results of the first phase of the current research programme. Later phases include a national random sample survey of the New Zealand public, trade modelling and synthesising results to aid end user decision making.

Chapter 2 provides a critical analysis of the relevant international and national literature on public perceptions of biotechnology. Chapter 3 follows this with a summary of the research methods used to gather the data. Chapter 4 presents the main results and begins with a discussion of participant's views on what they consider to be relevant, contemporary societal issues associated with biotechnology within New Zealand. After this the chapter continues with a more lengthy section, which focuses solely on the topic of biotechnology and its interpretation in everyday life. The focal point of Chapter 5 is that of nature and biotechnology, with more specific references to their relationship to clean green New Zealand and spiritual values. Finally, the report concludes with Chapter 6, which draws together our arguments into a concise synopsis of the research and considers the implications of the results.

Chapter 2
Theoretical Perspectives on Biotechnology

2.1 Introduction

Biotechnology covers a broad spectrum of processes that utilise and manipulate biological systems to make products. Whilst scientific research has focused upon improving and refining these market-oriented products and processes, governments and businesses worldwide have been injecting money into projects that explore the societal uptake of such novel biotechnologies. What do stakeholders such as the general public think about the usefulness and acceptability of the end products that appear on supermarket shelves and in pharmacies/hospitals?

In this chapter, we present a selective review of the literature that addresses public perceptions of biotechnologies both at the international and national level. These studies have been dominated by quantitative data, obtained through the use of nationwide and regional surveys. Such survey data has been gathered through mailing or telephone interviews. Whilst it is a useful source of information for commenting on generalities in public opinion, we will not dwell upon this methodological technique in great detail, nor on the results of the studies we cite. Rather, the key findings are simplified and reproduced. The primary reason for this stance is because our own research alternatively utilised the focus group technique. This method was chosen over "researcher-generated rating scales to assess the psychological factors associated with resistance to a particular technology" because it examines the "real concerns of the public" (Frewer et al.., 1998:389).

Although there is a paucity of research using qualitative methods, such as interviews and focus groups as a means of gathering data on public perceptions of biotechnology, we chose to narrow our review to these few case studies. They are therefore discussed in some depth, both in terms of the focus group methodology and key findings. In particular, since this study was strongly defined by the European PABE report, we provide a more detailed commentary on its evolution and conclusions.

2.2 International Perspectives on Risk Perception

Perhaps due to the controversial arrival of genetically engineered crops in Europe, it is not surprising that most of the international studies on public perceptions of biotechnology derive from this continent. There has been an expansive use of the survey technique as a tool to gather this data, and we present some of the most relevant findings below. These findings provide a platform from which to jump into the more substantive results from qualitative research in the field of public perceptions of biotechnological risk. It should be noted that the majority of these studies are focused on genetic engineering/modification, rather than the broader definition of what constitutes biotechnology. However, more recent qualitative research on xenotransplantation, cloning and inter-species boundaries has begun to emerge in the field of social sciences.

2.2.1 Genetic Engineering

Survey research on genetic engineering has been prolific, and spans the full range of issues from the role of attitudes and values, to gender differences, to perceptions of risk factors. Risk factors include elements of personal choice, access to information, a perceived

atmosphere of secrecy, naturalness, ethical acceptability and personal versus societal risk/benefit. Whilst these issues are certainly relevant and should not be understated, since this review has a specific focus on recent qualitative research, we have simply highlighted some of the main findings below that we find relevant to this report.

- Attitudes, values and worldviews have an influential role in colouring public perceptions of genetic engineering (Cook et al., 2002; Pardo et al., 2002).
- A gender difference in perceptions of genetically engineered products is supported by a limited amount of research. Notably, a significant number of men are more accepting of GE than women (Napolitano and Ogunseitan, 1999). However, this is contradicted by other focus group studies (see Frewer et al., 1998:391).
- A persistent reluctance to apply genetic engineering to food production, even though biotechnology in general is believed to be beneficial to humanity (Lujan and Moreno, 1994).
- More concern over IVF and GE - as applied to medicine - was expressed by the Japanese than New Zealanders. The major reason for the rejection of GE in both countries was that it was perceived as "interfering with nature, playing God or as unethical". It was concluded that the emotional response governing these perceptions is complex and the use of simplistic public opinion data to measure perceptions should be avoided (Macer, 1994).
- A perceived difference between research that focused on humans/animals and plants. Applications of GE that were associated with animals or humans caused ethical dilemmas and were described as "unnatural, harmful and dangerous". In contrast, plant or micro-organism biotechnology were seen as "beneficial, progressive and necessary" (Frewer et al., 1997).
- Genetic engineering and biotechnological innovations are perceived by many members of the public as "unnatural"; an inappropriate scientific intervention in "nature" (Gaskell, 2000; Shaw, 2002; Straughan, 1992). This implies that natural is good, unnatural is bad, and reflects a Romantic view of nature, where no interference should be allowed because it "tampers" with natural processes (Boulter, 1997:244).

Focus group research and interviews have explored some of these concerns in more detail, among consumer groups, teachers, students, and members of a diverse "general public".

Based on a textual analysis of the "Eurobarometer" linguistics and a series of interviews/focus groups held between 1996 and 1999, de Cheveigne (2002) examined the concept of risk, as it related to biotechnology and "risk management". She discovered that the word "risk" did not arise spontaneously among "Eurobarometer" respondent's replies. Rather, people were four times more likely to use the word "danger" as its synonym, particularly with respect to food, eugenics and "artificiality". Another key word in the debate was "fear", which expressed a more affective response to genetically modified organisms (GMOs) and was associated with monsters and a veneration of nature. Following this analysis were a series of focus groups that asked people to classify nine applications of biotechnology, based on their degree of risk, and what they meant by that. In all cases, risks were not simply material phenomenon, but drawn from social, political and ethical issues. Indeed, for many, these complex, multifaceted risks "were seen as the first step toward a *Brave New World*" (ibid.).

This perspective was supported by research in Germany, where attitudes towards genetic engineering were found not to be technology-related, but embedded in a "wider semantic space". In particular, based on historical experiences, Germans were concerned with

potential for the abuse of techniques such as cloning (through eugenics) and experiments with deliberate release of GMOs (Zwick, 2000).

In Swedish focus group discussions with non-experts, genetically modified organisms were interpreted as part of the overarching questions concerned with human agency, everyday epistemology and trust. Participants addressed ethical issues with questions, rather than answers. "Can we trust the information that we receive?" "Who is behind the information?" Who is informing?" How great is my responsibility and possibility for keeping myself informed?" "How do I know that what I know is right?" (Adelsward, 2001). These questions suggest an acknowledged unawareness stemming from a lack of access to reliable information, a trend that is typical among current research papers.

This acknowledged unawareness was reflected in interviews held in the early nineties with members of the UK public (Frewer et al., 1994). Access to key information on biotechnology was found to have an influence on these attitudes when they are at a stage when they are not fully crystallized. The information needed was not simply about risks and benefits, but on regulatory measures, reflecting a perception that risks were related to a perceived lack of control over new technologies. It was acknowledged by the researchers that the source of this information would play a significant role in its acceptability.

In contrast to Europe, where the issue of genetic engineering has been under intense debate, developments in the USA have been less controversial. However, in 1999, the Food and Drug Administration (FDA) commissioned a study on consumer attitudes to biotechnology (US Food and Drug Administration, 2000). Three public hearings were followed by a series of twelve "consumer" focus groups in Spring 2000 to help further national understandings of issues surrounding the development of biotechnology in the US. Three representative groups were held at each of four cities: Calverton, Maryland; Burlington, Vermont; Seattle, Washington and Kansas City, Missouri. Discussions predominantly centred around attitudes to GM foods – concerns, reactions to information on its prevalence and reactions to labelling options.

Many participants were aware of the uses of biotechnology in medicine and food production, but were vague about the details. Some had heard that European countries were against importing American-produced GM products, but the majority were unsure of the rationale behind this. Only a few people had any inkling of the processes involved with recombinant DNA manipulation, and some had very "fanciful" views on the topic. Rather, they were aware of biotechnology as a "new technology with great potential", but knew very little about it. Participants were, however, able to formulate a series of benefits and risks associated with the use of this technology. But the report suggests that "fewer dangers [than benefits] were identified", a national statement that seems to contrast strongly to that of Europe.

Nevertheless, American participants did relate to one European stance, and asserted that their major worry was long-term health problems that might not be identified by current scientific knowledge. This acknowledgment was often based on analogies to other technological innovations such as pesticides, growth hormones and antibiotic use. Interestingly, the American studies revealed an important linguistic difference between the words "genetically modified organism" (European term) as opposed to "bioengineered" products (US term). Most US participants were unfamiliar with the term "GMO", and "considered it to be a strange and inappropriate label for bioengineered foods since it seemed to imply that foods are organisms or contain organisms, which people think is inaccurate and unappealing" (ibid.: 4). Clearly, the cross-cultural linguistic differences have a bearing on the representation and hence public acceptance of GMOs.

Overall, in contrast to Europe, many participants believed that the risks of biotechnology should be tolerated for the sake of the benefits. In fact, there appeared to be a "degree of technological fatalism; the belief that ordinary people can't have much influence over the spread of new technologies, associated with the acceptance of food biotechnology" (ibid.: 4). However, participants were surprised when they discovered just how prevalent genetically engineered grain crops were in the US and how much "bioengineered" ingredients were present in processed foods. Their response did not focus upon health and safety, but on the fact that these changes had been instigated without their consent.

2.2.2 Xenotransplantation

Over recent years, xenotransplantation (the use of animal organs for transplantation into humans) has been the focus of a number of biotechnology-based research projects within the social sciences. A biomedical procedure, it is also a cultural phenomenon, for it involves the physical and symbolic manipulation of human and nonhuman bodies (Woods, 1998). Studies have utilised a number of research methods – surveys, interviews and focus groups – in their concentration on issues of what xenotransplantation means for self-identity and cultural meanings. Concerns have ranged from the issue of informed consent, to the need for life-long monitoring, to animal welfare and animal rights, and suitable regulation of the biotechnology. In October 2002, the journal, *Public Understanding of Science*, even ran a "focus" section on public attitudes towards xenotransplantation. This edition represents a milestone in research into this field, and some of the papers are summarised below.

In Japan, awareness about xenotransplantation rose from 43 per cent to 67 per cent of the population between 1997 and 2000. Surveys with the public suggested a divide in public acceptability, with 50 per cent of respondents in disagreement with its use, and 30 per cent supportive. Of these people, the major factors influencing their attitudes were the ability of xenotransplantation to save human life versus the issue of safety and some ethical reservations. The general public and school students also thought of it as an unnatural phenomenon, in comparison with scientists and university students (Macer et al., 2002).

Exploring the experiences of patients with diabetes and Parkinson's disease, one Swedish researcher asked interview participants whether xenotransplantation created new cultural meanings about the nature/culture and mind/body chasms (Lundin, 2002). He found that these people experienced a crisis, in which coping strategies were demanded on a day-to-day basis. This Swedish research continued with a survey, 'Attitudes of the General Public to Transplants', whose design was a collaborative project between ethnologists, medical scientists and geneticists. The project sought to expose the state of ambivalence that occurs when novel medical developments are juxtaposed to risk concepts. Through the use of a combination of quantitative and qualitative techniques, the complexity of people's views was emphasised. These views were based on a morality that was both personal and contextual. Namely, attitudes did not always coincide with what participants "normally" found to be ethically justifiable, and as a result were somewhat fluid (Lundin and Idvall, 2003).

The issue of xenotransplantation was explored in another Swedish survey that examined the willingness of the population to accept materials of different origins - live human, deceased human, artificial or animal – into their bodies. Whilst acceptability was high (between 85-95%), live human organ transplants were notably favoured over animal organs (77% as opposed to 40%). Supporters of organ transplants tended to be the most well-educated, younger, and male (Sanner, 1998). Sixty-nine participants from this initial survey were

selected for in-depth interviews about their feelings on xenotransplantation and organ donation. During interviews, participants focused on the crisis situation, the functioning of the transplant, the influence of the transplant on body image, disgust, cannibalism, tradition, ethics, the debt of gratitude and the perceived trespass over nature's order (Sanner, 2001a). Stemming from these interviews were also seven different 'attitude patterns' that captured distinctive series of attitudes and motives that were logical and meaningful to participants. Discussions focused on two different body conceptions. When the body was conceived as a machine, it was easily objectified and was not perceived as being representative of the self. This led easily to an understanding of body parts being replaced by "spare parts". In contrast, when the body was perceived as self, new organs would transfer the qualities of the donor to the recipient. Thus, a disruption in personal identity was perceived, with particular reference to behaviour, appearance and personality (Sanner, 2001b). These themes continue in the science of cloning.

2.2.3 Cloning Technologies

In 1998, the UK-based Wellcome Trust commissioned a report on public perceptions of human cloning and cloning technologies (Wellcome Trust, 2000). Their aims were twofold: to respond to a consultation document produced by the Human Genetics Advisory Commission and the Human Fertilisation and Embryology Authority, and to test the focus group technique as a method for consulting members of what they called an "uninvolved public" about their positions on the ethical and social dimensions of medical research.

The data that emerged was based on ten discussion groups and four interviews with couples. These methods were selected as a means to ensure that as many views as possible were explored and subsequently represented, and as a result, researchers enlisted a cross-section of the population. Group discussions initially focused upon general understandings of medical research and cloning, and were preceded by a half hour educational session on cloning technology. After one to four weeks, these groups were reconvened to explore any changes in perception that might have occurred during the interim period, after exposure to relevant scientific information and time to digest it.

The key findings of this report were as follows:

- **Cloning human beings:** "The public have fearful perceptions of human cloning and were shocked by the implications of the technology" (Wellcome Trust, 2000). This practice was rejected by the majority of participants and additional information did not modify somewhat resilient attitudes. The issue of identical genes was addressed with a debate on nature versus nurture in the production of self-identity.
- **Cloning technology in medical research:** Known as "therapeutic cloning", the topic only arose after prompting and explanation. Initially perceived as beneficial to health, after more information, reservations were expressed on the end use of this research. Ambivalence over the status of early stage embryos was expressed; some regarded them as human beings; others felt comfortable with research, when they were informed that the embryos could not feel pain until day fourteen.
- **Assisted conception and reproductive science:** In vitro fertilization was fairly well understood and accepted. Some participants did remember a time when it was new and hence "strange", realising that to some extent, familiarity breeds acceptability.

Overall, cloning was consistently rejected, contradicting the view of the consultation report that particular social groups might be open to such technologies. Rather, a cynical view of scientist's motives was adopted and an emphasis on the furtive nature of contemporary

bioscience. It was also noted that narratives from popular culture frequently entered into discussions on the topic of cloning.

2.2.4 Biotechnology in the UK

A number of studies have emerged in recent years from the Centre for the Study of Environmental Change (CSEC) and Institute for Environment, Philosophy and Public Policy (IEPPP) at Lancaster University, England. In response to British anxieties about the development of biotechnology and in particular, genetic engineering, reports have focused upon the public's attitude to new technologies (Grove-White et al., 2000), the use of animals in biotechnology (Macnaghten, 2001), and also the UK reaction to genetically modified organisms (Marris et al., 2001).

A series of twenty interviews with information specialists from manufacturing, retailing, government and NGOs, complimented a range of focus groups with representative samples of the public, in a study whose emphasis was on access to information about new technologies such as genetic modification (Grove-White et al., 2000). Ongoing research drew attention to the handling of scientific uncertainty and ignorance by key institutions. It was suggested that the institutional denial of risks in these "unknown" areas precipitated the emergence of controversies over GM.

In particular, the social assumptions and values embedded into the development of new technologies were found to have a bearing on public responses to them. Judgements were made through social interactions with trusted 'others', whether personal (friends) or institutional (NGOs, key brands). These assessments were seen as complex decisions, in contrast with the tendency of industry and government to view human beings as "rational consumers". Rather, "people's attitudes and values emerge and are sustained in relationship with others" (ibid.: 33).

A second report from Lancaster University focused upon the "grey area" between animals and their use in biotechnology (Macnaghten, 2001). More specifically, it emphasised public attitudes towards animals and their prospective use in biotechnological innovation. Employing the focus group method, discussions were double-edged, incorporating perceptions of animals in everyday encounters, and their use as objects of biotechnological research. Examples included cats that do not cause allergies or have their hunting instinct reduced/removed, sheep or cows that produce pharmaceutical products in their milk, mosquitoes that cannot transmit parasitic diseases and pigs that are bred to produce organs that can be xenotransplanted into humans.

In domestic and other familiar contexts, people spoke of close relationships to animals. Yet they also were aware of contradictory and even "hypocritical" behaviours towards animals, that swung from intimate family-based connections to acknowledgement of their exploitation for food, clothing and during medical/cosmetic testing. This was interpreted by researchers as a sign of "shifting social awareness of the tensions between 'moral' and 'instrumental' approaches to animals in modern society" (ibid: 5). Attitudes towards animals for experimental purposes were based upon a differentiation between medical and cosmetic purposes, yet it was acknowledged that the dividing line between the two was increasingly far from clear-cut. These interpretations were based upon pre-existing attitudes to current practices and relationships, as well as their perceptions of the research purpose and degree of exploitation involved.

When the topic of genetic modification of animals was raised, it was deemed both "new" and "unnatural". The genetic manipulation of animals was perceived as a "radical departure from nature"; a "violation" that was "transgressive of so-called natural parameters" (ibid: 25). Participants also questioned the real usefulness of GM animals, finding the applications "dubious, dangerous and unnecessary". There was a particular feeling that "messing with nature" (ibid.: 26) would rebound upon humanity. Yet an interesting outcome was that farmers were more inclined to see GM animals as an extension of the process of selective breeding.

Overall, public concerns seemed to span three broad areas. Firstly, there was an issue over the intrinsic nature of animals, and their right to maintain their integrity as sentient beings. Secondly, there were debates over animal welfare and the issue of ethical standards of care. Thirdly, reflecting concerns about biotechnology in general, people found the regulation and secrecy associated with institutional management of the use of animals to be somewhat suspect (ibid.: 6).

The final significant study emanating from Lancaster-based researchers was the PABE report, which will be outlined in more detail at the end of this review. This report provided a foundation for the current study. In the meantime, we narrow our focus to the New Zealand scene and zoom into relevant national studies on public perceptions of biotechnology.

2.3 National Studies on Biotechnology

New Zealand lies poised between two global economic markets – the apparently anti-GE Europe and the apparently pro-GE North America. Under the shadow of the moratorium, numerous studies have proliferated that attempt to answer the questions – whose lead to we follow? Do the New Zealand public foresee a future heralded by biotechnological innovation? And moreover, how do they feel about it?

At the national level, survey research has been prevalent, perhaps due to the geographically diverse nature of the New Zealand population and the need to reach respondents in more remote areas of the country. Mail-out surveys allowed the voices of such community members to be heard as part of a multi-faceted national voice. Again, a focus on GE dominated these studies, in a country whose primary exports are agricultural. Much of the research was funded by government bodies such as the Foundation for Research, Science and Technology, HortResearch and AgResearch. However, limited focus group studies on perceptions of biotechnology and possum controls have been undertaken. The Royal Commission Report also utilised a variety of qualitative techniques. We shall not deal with it in this discussion, but for an overview of recommendations, please refer back to the previous chapter.

What we can note is the emphasis on surveys of attitudes towards GE, the importance of possum problems in New Zealand (and the consequent need for effective controls) and the Independent Biotechnology Advisory Group's role in investigating New Zealanders' views about biotechnology.

2.3.1 Focus on GE

The 1996 Eurobarometer report suggested that New Zealanders were more adverse to genetic engineering than their counterparts in Japan, Canada or the EU. However, in contrast to other countries, they were more favourable towards genetic engineering in agriculture than medical applications such as xenotransplantation (Macer et al., 1997). This was supported by an

earlier New Zealand-specific study that, through interviews and surveys, found the public to be most apprehensive about the genetic modification of human cells. In contrast, they discovered the manipulation of plant cells to be the most acceptable application of GE technology (Couchman and Fink-Jensen, 1990). Following other international studies, public concerns pivoted around moral and ethical dilemmas and the potential for environmental and human hazards to manifest.

A number of survey projects were subsequently commissioned through AgResearch (Small et al., 2002a; 2002b) and HortResearch (Gamble, 2001; Gamble and Gunson, 2002; Gamble et al., 2000; 2002). With specific emphasis on GE/GM, their findings complimented those of the Royal Commission report.

- Women were found to be more "food safety-conscious" than men (Gamble and Gunson, 2002; Small et al., 2001).
- Most respondents were not adverse to gene technology as long as it was made clear it was not GM.
- Inter-species genetic modification was acceptable to some degree (on par with pesticide-sprayed clover eaten by a cow as opposed to GM clover eaten by a cow) and 'pharming' (insulin producing cows) deemed acceptable, as it provided benefits, even though it involved cross-species gene transfers (Gamble and Gunson, 2002).

The aim of Gamble et al.'s (2000; see also Gamble, 2001) study was to investigate the New Zealand public's perception of transgenic plant products. More specifically, it aimed to "scientifically measure and explain" the perceptions New Zealanders had about GE. The research used focus groups of consumers, growers and handlers (to gain an understanding of topical issues), to assess the influence of GE on consumers purchase intentions and a national survey using a representative sample. From the focus group discussions, the following themes emerged:

- GE has a strong association with treatments of food (pesticides and additives) that was perceived to be "unsafe".
- Consumers perceived a lack of choice and control over GM foods due to the lack of labelling. Desire for labelling was dependent on product category, context and consumer (e.g., a healthy item vs. snack food).
- Concerns arose over the "unknown" short and long term risks on health and environment.
- Big businesses were perceived to have a monopoly over information diffusion, access and policy formation/regulation.
- Awareness was high, but again, people perceived themselves to know very little about the topic. A high degree of trust was needed for this information to be believed.
- More moral concerns included the idea that "the technology is 'going against basic principles', is 'unnatural', or is 'playing God'" (Gamble, 2001:3).

Overall, the report suggested a risk-benefit trade-off analysis in attitude formation (risks perceived to outweigh benefits, as the benefits are not fully known). Consumers would be more likely to buy GM if it was labelled and accepted in society. Thus, "products that are identified as GM, and offer relevant benefits to consumers may well be accepted quite readily, as long as the moral objections to the technology are addressed" (ibid.).

A valuable report from Cronin and Marchant (2002) provided thorough coverage of the communication of biotechnology adoption in New Zealand. Using the interview technique with fifteen participants, it focused upon the discourse between scientists and their audience, and how this was perceived by members of a specific local community in the Kapiti District, north of Wellington. More specifically, it investigated:

- General perceptions of biotechnology, especially GE, held by stakeholder groups. This included variations on its acceptance among different groups.
- Current communication methods used by scientists and other interested parties in this debate, including how people learnt about the issues and the perceived value of sources used.
- Levels of trust among non-scientist stakeholders in scientist and science institutions; and of scientists in other stakeholder groups.

Interviews focused on the way people communicated and how they saw that communication. Results indicated that respondents had a good knowledge of biotechnology and GM/GE, which has particularly been furthered over the last 3-5 years. Following other reports, people were inclined to indicate how little they knew about biotechnology and hence underrate their knowledge. Nevertheless, this study suggested that people seek out information and wish to be better informed and involved in this debate.

Information was communicated in various ways between stakeholder groups: news media, print and electronic sources were said to be influential, yet not necessarily trustworthy sources of information. Respondents called for more in-depth current affairs programmes on television and in-depth treatment of the topic. Scientists were an under-utilised source of information, suggesting they needed to integrate into communities and enhance their professional communication skills.

The report concluded that there is potential for a different form of discourse on the GM debate in New Zealand and that scientific information would be a valuable input into it, rather than the subject of dispute.

2.3.2 Possum Problems

During the 19th and early 20th centuries, the Australian brush tail possum was introduced to New Zealand for the purpose of establishing a fur trade. However, with a lack of predators, the possum population found a niche, rapidly diffusing throughout the country. Today, average densities are 20 times higher in New Zealand than in Australia. A major threat to biodiversity, the possum has been labelled New Zealand's number one vertebrate pest. Currently, the two primary control methods are the use of poison (1080) and trapping. However, these methods are considered to be inhumane, trapping and poison impact upon members of the wider ecosystem, and the possum problem is more widespread than these localised methods can effectively handle.

Following polarised debates on proposals to release biological control agents into the environment to address the possum problem, the Parliamentary Commissioner for the Environment decided to explore public attitudes about some of these potential solutions (Blasche et al., 2000). Investigations took place against a local, national and international backdrop of intense public debates on genetic engineering.

Initially, a reference group of twelve members was established, that provided advice and guidance on the project. Their research methods included a number of focus groups with New Zealanders, and meetings/interviews with tangata whenua and other stakeholder groups. Social scientists from Landcare Research were involved in two types of focus groups – meetings with the 'general public' and meetings with representatives from stakeholder groups such as scientists, public health professionals, farmers, members of the pest control industry

and people with ethical and environmental concerns. Focus groups that addressed gender and rurality were also conducted.

Participants were given an information pamphlet on the nature of the possum problem and the variety of biocontrol methods under investigation, in advance of focus group meetings. Options included sterilisation via a toxin that targets hormonal processes, genetically engineered techniques for contraception or sterilisation of the adult possum, and interfering with the "survival of the pouch young" (ibid.: 8). Outlined in the pamphlet were a series of suggestions for possible delivery mechanisms such as GM parasites or viruses, baits, aerosols and transgenic plants. Finally, a series of questions on the issues that had been raised were added to facilitate discussion during the focus group sessions.

In addition to the pamphlet, another valuable information source was one senior scientist involved in the research, who was present at each meeting, who helped clarify scientific matters. The discussions often led to quite animated debates. These debates revolved around participant's understanding of the problem, their attitudes to biological control methods, an evaluation of the various methods, concerns about GE in general and the identification of critical issues for the future development of biocontrols.

Focus group participants were interested in biocontrol measures, but their acceptability was tainted by underlying concerns about the use of genetic engineering. These concerns ranged from ethical and cultural issues, to implications for the Treaty of Waitangi, to anxiety over risks and benefits and more common concerns over safety and "unforeseen consequences". The study identified a range of key criteria for the acceptability of new possum biocontrols. These criteria included humaneness, effectiveness, specificity to possums, rigorous and long-term testing of the product and full public involvement in the decision-making process. Of the biocontrol methodologies outlined, the hormonal control option (sterilisation) was most favoured by participants, as it did not involve GE. In contrast, interference with offspring was considered inhumane.

Delivery methods were poorly rated, mainly due to their reliance on GE technology. Genetically modified native plants were almost unanimously rejected, GM viruses were considered to be "high-risk" and GM baits (made from processed non-native plants) were assumed to be lower risk, but no more efficient than current methods. However, GM parasites such as possum gut worms were not ruled out by participants.

The focus groups highlighted the diversity of public values and worldviews that impacted upon their perception of possum biocontrols. Objectives, purposes and priorities of different stakeholder groups and individuals lay outside standard scientific frameworks. The commission concluded that space needed to be made for these alternative perspectives, and new models for dialogue and decision-making should be forged.

2.3.3 The Biotechnology Question

In 1999, an Independent Biotechnology Advisory Council (IBAC) was established to investigate the views New Zealanders held about biotechnology. A booklet entitled, *The Biotechnology Question* was produced and distributed among the general population as a means to "stimulate dialogue and enhance public understanding of biotechnology" (Mackay et al., 2000). New Zealanders were invited to respond to a series of questions related to the information presented and express their views on it. In addition to the 254 responses received, eight focus groups of ten participants were convened in Whangarei, South Auckland, Nelson and Christchurch, to verbally address these questions. Participants in these

regional centres came from a range of backgrounds (elderly, parents, youth, rural, Maori, general community) that were divided between North and South Island.

The term 'biotechnology' posed itself as a problem for some participants, with some confusion over its definition and scope. The scope ranged from the broad scale (a set of scientific techniques) to the specific (techniques such as genetic engineering). Although various applications were acknowledged, extreme caution was emphasised, and the development of ethical leadership and regulatory frameworks. Risks were primarily identified within the field of agriculture, and included the perceived power and lack of integrity of large corporations, containment and 'knowability' of risks, biodiversity loss and threats to the natural order and concerns with specific process involved in genetic engineering. Prompted by questions, participants identified seven key areas that should comprise the focus of further research:

- The safety of GM goods
- Environmental issues
- Corporate control
- New Zealand-specific issues
- Philosophical issues
- Patenting issues
- National regulation

Although opportunities for biotechnology were seen to be most prevalent in the medical and agricultural arenas, some participants also recognised that the rejection of genetic engineering would open up opportunities in the organic market. There was an overriding concern that the expansion of biotechnology threatened New Zealand's 'clean green' image.

There was a particular need expressed for IBAC to provide independent, objective information to the public and include in its composition, members who could advocate for philosophical, spiritual, environmental and also Maori issues. These 'philosophical concerns' often pivoted around the power relationships set up by when science is taken as an 'objective' reality from which all other standpoints be compared. Alternatively, participants in the study highlighted the relevance of different worldviews that encompassed Judeo-Christian beliefs, the role of quantum physics in DNA manipulation and our role in Nature (ibid.: 15). Moreover, it was argued that spiritual values should not simply be allocated to Maori; "D*o Maori have exclusive ownership of cultural and spiritual views? I have these feelings too*". We believe that this report suggests a strong need to embrace the role of New Zealander's worldviews in decision-making over biotechnology.

2.4 The PABE Report

An exemplar of the above articles and reports was the Public Perceptions of Agricultural Biotechnologies in Europe (PABE) Report, which was funded by the European Commission and published in 2000. This report was something of a milestone in research into public perceptions of biotechnology, for the simple reason that it questioned the narrow use of the term, "the public", by stakeholders in the debate. It then argued that as a result, "public" responses to GMO's were also misunderstood and misrepresented. Research revealed a more complex situation than was utilized in policy decisions, "in which the distinctions often made between 'real risk' and 'perceived risk', between 'risk' and 'ethical concerns', or between 'scientific' and 'non-scientific' concerns are blurred" (Marris et al., 2001:7).

The study was based on cross-referencing two types of results about public perceptions of agricultural biotechnologies (with a specific focus on GMOs). These were:

- Perceptions gleaned from focus groups with "ordinary citizens" in France, Germany, Italy, Spain and the United Kingdom (55 sessions).
- Stakeholder perceptions of how the public responded to GMOs were studied, after a series of interviews, participant observation and document analysis.

These methods revealed a huge rift between public views and stakeholder's perceptions of the public. In particular, the resultant data critiqued a series of ten myths that characterized stakeholder views. These myths, and their critiques, are summarised below.

"Myth 1: The primordial cause of the problem is that lay people are ignorant about scientific facts."

Whilst studies acknowledged that in terms of scientific knowledge and understanding about GMOs, participants were lacking a technical background, this did not explain their response to the biotechnologies discussed. Rather than being based on erroneous beliefs, a number of very rational questions were raised that focused upon issues of access to information, accountability for potential hazards, just who was pulling the strings, regulatory controls, risk assessment, potential beneficiaries, the need for personal choice and once again, the need to take notice of scientific uncertainty and ignorance in institutional decision-making. Furthermore, participants based their responses, not so much on emotions or a subjective stance, but on empirical knowledge gained from everyday life. This situated knowledge encompassed a non-specialist awareness about:

- The behaviour of 'natural' phenomenon such as insects, plants and animals (often ignored or omitted from scientific debate).
- Experiences of human failings (which led to the realization that well-intentioned rules were not often fully applied in the real world) and,
- An understanding about the historical behaviour of governing bodies with regards to risk management (which was deemed unsatisfactory).

"Myth 2: People are either 'for' or 'against' GMOs."

Rather than being crystallized into a polarized debate, attitudes towards GMOs were "nuanced and sophisticated" – ambivalence dominated a number of very complex, multi-faceted discussions. Both positive and negative impacts were recognized and discussed.

"Myth 3: Consumers accept medical GMOs but refuse GMOs used in food and agriculture."

Although participants distinguished between specific applications, this could not be simplified to a dichotomy between medical = good, agriculture/food = bad. In general, medical uses were more favourable, but this was not purely based on personal benefit. Rather, access to information and safety regulations were perceived to be better in the medical field.

"Myth 4: European consumers are behaving selfishly towards the poor in the Third World."

Many of the benefits that GMO proponents claimed, were viewed with scepticism. These included claims about improvements to health, a reduction in pesticide usage, an

improvement in agricultural efficiency, but most significantly, the need to "feed the world" through GMOs was viewed as a manipulative marketing tool.

"Myth 5: Consumers want labelling in order to exercise their freedom of choice."

This concern had far deeper roots than simply a means for participants to protect themselves from health risks. Rather, labelling provided a means to boycott products (making a definitive consumer statement), and to allow monitoring of any unintended side-effects, and subsequent removal from the market if they emerged. It was also perceived as a statement of "we have nothing to hide" on the part of promoters.

"Myth 6: The public thinks – wrongly – that GMOs are unnatural."

Although participants did often describe GMOs as "unnatural", this did not imply that they assumed other agricultural innovations such as conventional breeding techniques, pesticides and fertilizers were "natural". For many, GMOs were seen as the most recent addition to a well-established trend of modifications to nature rather than a post-modern fracture in previous techniques. Consequently, the boundaries between what counted as "natural" and "unnatural" were not determined solely by the use of GMO technologies; the focus groups providing some clues as to how this concept of naturalness was socially constructed.

"Myth 7: It's the fault of the BSE crisis: since then, citizens no longer trust regulatory institutions."

Overall, there was a feeling that policy makers had not learned from their mistakes. Although BSE was mentioned, it was referred to as an exemplary rather than singular case from which judgements about regulatory bodies were made. Scepticism was based on past behaviour, which was deemed "ordinary" for such institutions.

"Myth 8: The public demands 'zero risk' – and this is not reasonable."

There was no demand for "zero risk" or complete certainty over the future of GMOs. This was based on their understanding of participant's everyday lives, characterized by a complex interplay of risks and benefits that had to be constantly negotiated. As a result, it was felt that science could never accurately predict the outcomes of its experiments, and this should be publicly acknowledged by expert institutions. Denial was seen as "untrustworthy".

"Myth 9: Public opposition to GMOs is due to 'other – ethical or political – factors.'"

Many concerns were raised that did not directly relate to the scientific definition of risk. Furthermore, ethical and socio-political issues could not be easily disentwined from science or risk management. Instead, underlying factors blurred the boundaries between science and politics, risk and ethics.

"Myth 10: The public is a malleable victim of distorting sensationalist media."

Although not designed to examine the relationships between media and lay people, the study confirmed previous assertions that people were not sponges that absorb the mediated environment that surrounds them, but engage in interpretations and judgments of the information that is presented to them (Marris et al., 2001:76).

Not surprisingly, issues of trust dominated the narratives of focus group participants. Argued to be an important dimension in public responses, the way the public was conceived in institutional circles was misleading and unproductive. Rather than simply being solved by improved science communication, the issue of trust was embedded into the whole range of socio-cultural factors identified in the report. Consequently, more profound changes would be required, such as the admission of past errors, fallibility and uncertainty, explaining the role of socio-cultural factors in decision-making, being more transparent in just how decisions were made (risk assessments), the imposition of heavy penalties for

mismanagement or fraud, and demonstrating that the publics' views are acknowledged, fully comprehended, respected and used by decision-makers.

The PABE report also asked why there was such an impasse between stakeholder perceptions of the public and the way the public view GMOs. They attributed this to three major elements.

- Media coverage wrongly claims to represent the public view. This media coverage was usually biased and often inaccurate.
- Stakeholders have limited access to public opinion, which is often relegated to key actors in the debate such as NGOs and trade union representatives.
- Opinion surveys such as the Eurobarometer may be misleading as they use closed questions that only allow respondents to express a degree of support or rejection for carefully selected exemplars. These fixed categories partly contribute to an explanation of the representation of the public as either 'for' or 'against' GMOs. More nuanced attitudes and values cannot be captured in this type of survey. Rather, they remain hidden as the 'don't knows', that are often overlooked during analysis. This problem is mitigated when stakeholders rely heavily on the superficial evidence provided by raw data, rather than more complex analyses (ibid.: 88). In contrast, the authors argued that the open-ended nature of focus groups means that discussions can "facilitate the expression of more ambiguous or complex public responses" (ibid.: 89). They advocate for the development of mixed methods, where focus groups can compliment quantitative studies by explaining seemingly inconsistent results.

These conclusions are highly pertinent to our biotechnology research programme that utilises both focus groups and surveys to gain an understanding of the attitudes and values underpinning public perceptions of novel biotechnologies in New Zealand. To conclude this chapter, we summarise the current status of research and draw out its implications for this study.

2.5 Summary

Research into the intersection of biotechnology and public opinion has been dominated by the survey technique, with fewer studies utilising interviews and focus groups. In this chapter, we outlined some of the key points made by the survey research, but our attention concentrated upon qualitative research. We summarise these main points below.

There were interesting and relevant differences in public opinion about biotechnology between Europe, New Zealand and the USA. These differences were based upon levels of awareness about GE/GM. It could be speculated that the most unaware members of the public and the most aware were also the least fearful. Thus, the US public, who were not aware that GM was in so many of their foods were fairly complacent about genetic engineering until this fact was revealed to them. On the other hand, rurally-based New Zealand was also less fearful of the use of GM in agriculture.

The concept of "risk" that has been widely used in biotechnology-related studies, is often replaced by the words "danger" and "fear" in everyday life. There is clearly a discrepancy between elitist technical language and the discourses used by the public that are situated in a wider semantic space. The fears associated with risk perception have many origins, but are usually historically embedded in past misuses of power such as the eugenics movement in Nazi Germany.

Trust and a lack of access to information were consistently cited as being important issues to the public. Supported by work in the UK, it would seem that public controversies about biotechnology are directly influenced by the institutional denial of the risks associated with new biotechnologies. People would rather be informed about any potential risks than live in an atmosphere of secrecy and denial. Moreover, they do not expect a zero risk environment.

Attitudes, values and worldviews are of key importance in shaping public responses to new biotechnologies. They values emerge from negotiations with social institutions and trusted others, and are sustained in complex interrelationships. Of these, attitudes to nature, concern with animal welfare, safety, thoughts about capitalism, identity (personal and national) and spiritual orientation (not simply for Maori) were important indicators of participant's reactions.

Cloning has been internationally rejected, and its reference evokes a fearful response in most study participants. This is particularly the case for human cloning, which raises questions over the future and definition of self-identity. However, therapeutic cloning was not as controversial, for its medical benefits could be seen.

Attitudes to xenotransplantation did not always correspond to what participants normally thought to be ethically justifiable. Moreover, it was thought to "trespass" over nature's border (note biblical words), and was associated with cannibalism. These attitudes linked nature to human bodies, for they were highly dependent on the way participants viewed their bodies: were they simply a machine or an integral aspect of their self-identity?

Studies on the use of animals in biotechnology confirmed that there was a conflict between moral and instrumental approaches. The genetic modification of animals was perceived as new and unnatural, based on the close relationships people had with domesticated animals. As a result, it was seen as a transgression of nature that would eventually rebound on humanity. However farmers were more likely to see GM as the extension of traditional breeding processes. The concept of what was considered to be unnatural was associated with levels of awareness and education, too. For instance, university students and scientists thought GM was more natural than the general public and school children.

In New Zealand, genetic engineering was perceived more as "playing god" and associated with unknown risks. This was based on previous experiences, such as Corngate, the possum explosion and "the unfortunate experiment". One solution to the possum explosion involved the use of GM as a means to control fertility among the population. However, participants typically were adverse to the proposed measures, displaying a reluctance to use genetic engineering even in the face of a well-cited problem. Their concerns were primarily based on safety measures.

Chapter 3
Approach to the Focus Group Research

3.1 Introduction

Much of the literature on public perceptions of biotechnology suggests that there is a perceived gap between "objective", clear-cut scientific knowledge and the "subjective", "soft" attitudes and values of the public that are derived from everyday life. But is this dichotomy irreconcilable? Should scientific knowledge be valued over personal experience? In this report, we take the stance that the opinions gathered from participants have due merit and validity. Our stance is based on the well-cited work of biologist, Donna Haraway (1991) that critiques the power-laden structure of scientific knowledge and replaces it with her own version of a feminist rationality: 'situated knowledges'. A brief discussion of this issue will be followed by a critique of the focus group method, a description of the methods we used to recruit participants, an overview of the research process and a presentation of the demographic profile of our participants. But first, we turn to Donna Haraway.

3.2 Situated Knowledges

Donna Haraway calls science and scientific method, the "God trick", the "view from above". An emphasis on vision in scientific techniques has been used in a perverse capacity, "to distance the knowing subject from everybody and everything in the interests of unfettered power" (1996:253). Alternatively, in an age of increasing reflexivity (Beck, 1992; Giddens, 1990), there is room for a new, imagined type of knowledge that gives credence to producers of information at all scale levels.

As an alternative to this "God trick of seeing everything from nowhere", Haraway calls for the instigation of "situated knowledges" produced from an embodied and lived positionality in the world. She states her logic in the following excerpt.

> I am arguing for politics and epistemologies of location, positioning and structuring, where partiality and not universality is the condition of being heard to make rational knowledge claims. These are claims on people's lives. I am arguing for a view from a body, always a complex, contradictory, structuring, and structured body, versus the view from above, from nowhere, from simplicity (Haraway, 1996:257-8).

To support these claims, Haraway emphasises the embodiment of all primate vision (including technological mediation) and the ongoing processes of interpretation and criticism among communities of embodied interpreters (1996: 257). The knowledge that is produced can be called "rational", but is always in the process of becoming – production is an ongoing process.

For Haraway, objectivity "is about limited location and situated knowledge, not about transcendence and splitting of subject and object. It allows us to become answerable for what we learn to see" (1996: 254). And what we learn to see, as researchers, is based upon our embodied sensory systems that extend beyond the mere gaze, into the auditory, tactile and olfactory realms. It is also reliant on the makeup of our "knowing selves", that are always

partial, never complete, our identities never whole, but imperfectly stitched together and thus in a position to be able to join with others, without the need to claim the identity of the other (Haraway, 1996: 257). Based on these premises, we have some comments to make about our approach to the research and our participants.

- It was not our aim to realistically portray the worlds of our participants, for such attempts at representation undermine a subject's integrity. Rather, we followed Haraway and stuck to the "politics of interpretation, translation, stuttering, and the partly understood" (Haraway, 1996:258) in an attempt to reproduce a form of "objective knowledge" based upon the intersection of our subjects and ourselves.

- Haraway's epistemology is suggestive of a dialogic approach to interviewing, one that produces a text, not based solely upon participants' view of their world, nor our own desires and biases, rather, this text is a snapshot of the complex interrelationships between research subjects and their interpretations of the world. In this study, knowledge was consequently produced by the establishment of a tentative rapport and focused conversations. This knowledge is locatable in time and space, and hence, "accountable" (Haraway, 1996:255-6). It can be recalled. But the knowledge encompassed in this report is already outdated, for both the attitudes of participants and ourselves have been transformed both through the focus groups and further life experiences.

- Finally, both during focus groups, analysis and representation, we had to maintain a number of different subject positions, sometimes coherent, sometimes disjunct. This involved simultaneously being qualitative researchers, women with our own interests around biotechnology, and our everyday selves in all their guises. In this research, each of these subject positions gave us partial perspectives on perceptions of biotechnology, yet when they were written into the text of this report we became aware that they are sometimes irreconcilable. The question emerged: Which one of these standpoints do we take to represent the data? And is it possible to simply take one stance?

3.3 Focus Group Methodology – A Rationale

In this section we explore the development of focus groups as a valuable method of conducting social research and we examine some the strengths and weakness of using focus groups to collect qualitative data.

Focus groups have their roots in social research of the late 1930s when social scientists were investigating the value of nondirective individual interviewing (Kruger, 1994). In 1931 Stuart Rice wrote that "A defect of the interview for the purpose of fact-finding in scientific research, is that the questioner takes the lead…Information of points of view of the highest value may not be disclosed because of the direction given the interview by the questioner (from Kruger, 1994:7)". It was out of this concern with the interview process and a desire to come closer to the participants' understanding of an issue that focus group interviews came into being. In the intervening years focus groups lost some ground as a social research method but has become an important tool in marketing research (Edmunds, 1999; Greenbaum, 1998; 2000; Kruger, 1994). However, the method has regained popularity with social researchers since the 1980s (Cameron, 2000).

Focus groups, in their most basic sense are discussion groups in which a moderator helps to focus the discussion on the research topic. Typically a group of four to 12 people gather around a table with a moderator and a note-taker. The moderator's task is to promote interaction between group members, focus the discussion on the research topics and probe the participants to evaluate the topics in-depth (Cameron, 2000; Kruger, 1994; Marris et al., 2001). The sessions typically last one to two hours and are audio or videotaped for transcription to aid in the analysis.

3.3.1 Strengths

Much has been written of the relative strengths and weaknesses of focus groups. In many cases the strengths and weakness are interconnected. David Morgan (1988) argues that the one of the greatest strengths of focus groups is the flexibility to explore topics and to generate ideas but that the corresponding weakness is that the researcher has limited control over the data that is produced. We argue that the strength of the explorative aspect of focus group research is key to the understanding of the public's attitudes towards biotechnological innovations. The key assets of focus groups include: flexibility, the interaction with the group of participants and with the researcher, the ability to explore and seek clarification on new topics as they arise, to come closer to the participants understanding of a topic, to include the voices of participants who are sometimes overlooked, and the high face validity of focus groups.

A vitally important element of the focus group is the interaction between participants, which provides insights that might not have been revealed through other methods (Cameron, 2000; Morgan 1988). This interaction allows participants to consider other perspectives and reconsider their own ideas and understandings of the topic in light of what other group members have to contribute (Cameron, 2000; Pini, 2002). A researcher's comment may also trigger the psychological release of details that the respondent had forgotten (Knap and Propst, 2001). The interactive nature of focus groups leads to relatively spontaneous responses from participants that may approximate their natural decision making process and allow them to seek clarification as needed (Knap and Propst, 2001; Morgan, 1988). Spontaneity and social interaction in focus groups provide a valuable opportunity for the researcher to seek clarification on statements, ask follow-up questions, probe the respondents on issues of interest and explore unanticipated responses (Krueger, 1994; Stewart and Shamdasani, 1990).

One of the primary goals of focus groups is to come closer to the participant's understanding of the research topic. "Focus groups are useful when it comes to investigating what participants think, but they excel in uncovering why participants think as they do (Morgan, 1988:25)." Stewart and Shamdasani (1990: 12) argue that, "focus groups produce a very rich body of data expressed in the respondents' own words and context." Furthermore the richness of the data allows researchers to gain a more complete understanding of the "complexities of social reality" (Knap and Propst, 2001: 62).

Focus groups prove to be a valuable resource when attempting to ascertain the attitudes of a cross section of society, especially when dealing with typically underreported groups. The interactive and informal nature of focus groups makes it easy for the participants to participate. Moreover, personal contact can broaden the understanding of the perspectives of groups that are typically underreported including: ethnic or cultural groups, people with allow level of literacy and the views of the very young or very old (Knap and Propst, 2001; Stewart and Shamdasani, 1990).

Focus groups have been praised for having a high degree of face validity (Krueger, 1994; Stewart and Shamdasani, 1990). People find the method and results of focus groups to be straight forward and easily comprehensible (Krueger, 1994; Stewart and Shamdasani, 1990).

Focus groups have been described by researchers as a refreshing and invigorating experience (Cameron, 2000; Pini, 2002). However, Barbara Pini (2002) offers additional words of caution about two of the most frequently cited advantages of focus groups. Focus groups are repeatedly praised for providing the researcher the ability to gather a large amount of information in a limited time frame and with a limited budget (Krueger, 1994; Morgan, 1988; Stewart and Shamdasani 1990). Pini (2002:343) cautions that in her experience there are huge demands on personal resources when conducting this type of research. She argues that considerable attention be given to design, efforts to draw participants, keeping the discussion on track and the analysis of vast amounts of data. However, she also states that this work is "not without reward."

3.3.2 Weaknesses

As with any research method there are limitations to the usefulness of focus groups. As such, focus groups cannot and should not serve as a substitute for the kinds of research done well by other methods. Rather, they should be used because focus groups provide access to forms of data that are not easily obtained with those other methods (Morgan, 1988). The weaknesses of focus groups that are most often cited relate to: the limited control over the data produced, the ability of the researcher to influence the data, the difficulty assembling the groups themselves, the time consuming nature of data analysis, and the inability to generalise the findings to a larger population.

The first limitation we will discuss is the limited control that the researcher has over the data produced. As mentioned earlier, this related to one of the greatest strengths of focus groups. The flexibility of the focus group and the ability to follow up on unexpected topics results in the researcher having limited control over the data produced (Krueger, 1994; Morgan, 1988).

The relative plasticity of the focus group is also related to the second relative weakness of focus groups, the researcher can knowingly or unknowing influence the data based on the interaction between the researcher and the participants (Stewart and Shamdasani, 1990). To lessen the risk of bias it is important to have a well-trained and experienced moderator (Krueger, 1994).

The focus groups themselves can be time consuming and difficult to assemble, as the process requires that people take time out to come to a specific location to participate (Krueger, 1994). On a related note the people who are willing and able to participate in the focus group process may be of a specific subset of the population and this may significantly limit the generalisablity of the sample (Stewart and Shamdasani, 1990).

Summarizing and interpretation of the data produced in focus groups is difficult (Krueger, 1994; Stewart and Shamdasani, 1990). The discussion from the focus groups must be transcribed and analysis of the transcripts is very time consuming. Moreover, validation of the analysis is required (Knap and Propst, 2001). Finally the researcher needs to be cautious in the use of quotes to ensure that comments are not taken out of context (Krueger, 1994).

The findings of focus groups are not generalisable to the wider population (Cameron, 2000) and can be very challenging to duplicate (Knap and Propst, 2001). However Cameron (2000) reminds us that the combination of focus groups with quantitative surveys is an extremely

useful way of alleviating this issue. And Knap and Propst (2001) suggest that focus groups provide a very valuable aid to constructing quantitative surveys**.**

In sum, we argue that focus groups are an extremely valuable tool for conducting explorative social research. The process allows the researcher to a come closer to understanding how participants think and why they think that way. The flexibility of the focus group is crucial for its success, as it allows the researcher to explore unanticipated topics and delve deeper into comments made by participants. Meanwhile the spontaneous and interactive elements of the groups encourage a level of naturalness to the discussion providing valuable insights for the researcher. Many of the criticisms leveled at focus groups relate to the lack of generalisability and the pitfalls of the data analysis but the very issues that make the processes vulnerable also offer it's greatest strength as an explorative tool.

3.4 Recruitment

Following a well-established method of recruitment, suggested by one of our note takers, school parent teachers associations (PTAs) were contacted around New Zealand. They were provided with an information sheet and a list of criteria for a 'representative' sample of people from the local area. As an incentive, PTAs were offered $200, and participants paid $50 for their time (2-3 hours). The first group was held in a hotel, but this approach was too formal, and subsequent meetings were held in the evening in school staff rooms.

3.5 Research subjects/locales

The research was conducted in two phases. The first phase, which gave us the opportunity to develop our approach to conducting the focus groups, was comprised of two focus groups in Christchurch and Dunedin in South Island, New Zealand, completed during December 2002. These two cities are the largest in the South Island, and being in close proximity to one another were suitable locales from which to initiate this exploratory stage of the research. Participants' comments and the themes that arose from them were then used to construct a framework for phase two, which spanned Christchurch, Dunedin, Nelson, Waimate, Waipukarau and Wellington. Three focus groups were held in Auckland, encompassing Western Europeans, Pacific Islanders and Asians. No focus group was held specifically, for Maori, but they were integrated into general sessions. This was to avoid overlap with the work of Mere Roberts, who focused exclusively on Maori and biotechnology.

All eleven focus groups involved the presence of a note-taker and tape recorder, and were subsequently transcribed verbatim. After analysis, the data was integrated with field observations from the focus groups themselves and also everyday life. In both phases of focus groups, participants were also asked to fill out a short demographic survey. These results are outlined below and provide a simple springboard from which to interpret the data.

3.6 Demographic Data

The demographic questionnaire comprised 12 questions printed on a double-sided A4 sheet. Respondents were asked to indicate: their name, age, sex, martial status, number of children, nationality, ethnicity, place of birth, employment status, occupation, income and highest educational qualification. Thirty-two of the 117 participants did not complete the three questions on the second page of the questionnaire.

This section will provide a snapshot profile of the 117 New Zealanders who participated in the ten focus groups conducted nationwide. The number of participants in each focus group varied from ten to 12 people. Table 1 shows the age distribution of focus group participants. Thirty-one per cent of the participants were between 41 and 50 year of age and an additional 21 per cent were between 31 and 40 years of age. Respondents between the ages of 31 and 50 years of age comprised 52 per cent of participants.

Table 1 Age category

	Frequency	Per cent
20 or younger	11	9
21 – 30	16	14
31 – 40	24	21
41 – 50	36	31
51 – 60	14	12
61 or older	16	14
Total	117	100*

* Sums may not equal 100 due to rounding. This applies to all tables in this report.

Table 2 illustrates the proportions of male and female participants. Forty-nine per cent of respondents were female and fifty percent male. One individual declined to indicate their gender.

Table 2 Gender

	Frequency	Per cent
Female	57	49
Male	59	50
Missing data	1	1
Total	117	100

Table 3 illustrates the marital status of participants. The majority (63%) of participants were married people. Eighteen per cent of participants identified themselves at single and seven per cent indicated that they had live-in partners. A small proportion of participants were divorced, separated or windowed (4%, 3% and 3% respectively). Three participants opted to not indicate their marital status.

Table 3 Marital Status

	Frequency	Per cent
Married	74	63
Live-in partner	8	7
Divorced	5	4
Separated	3	3
Single	21	18
Widowed	3	3
Missing data	3	3
Total	117	100

Respondents were asked to indicate the number of children that they had, the results of this question are presented in Table 4. Twenty-two per cent of respondents reported having no children. A clear majority of participants were parents; 76 per cent had at least one child. Ten per cent of respondents had one child, 33 per cent had two children, 18 per cent had three children and 14 per cent indicated that they had four or more children. Two per cent of respondents chose not to indicate if they had children or not.

Table 4 Numbers of Children

	Frequency	Per cent
0	26	22
1	12	10
2	39	33
3	21	18
4 or more	17	15
Missing data	2	2
Total	117	100

Attempts were made to ensure a diverse pool of participants whose nationality approximated that of the New Zealand population. Table 5 illustrates the nationalities of participants. Clearly, a vast majority of respondents (73%) linked their nationality to New Zealand. A number of other nationalities were reported with each of the following accounting for 3 per cent of the sample: British, British/New Zealand, Chinese, Samoan and Tongan. One person in the sample chose not to indicate his/her nationality.

Table 5 Nationalities

	Frequency	Per cent
American	1	1
British	4	3
British/NZ	3	3
Chinese	4	3
Fijian	2	2
Filipino	1	1
Indian	2	2
Indonesian	1	1
Malaysian	1	1
Niuean	2	2
Niuean/Tongan	1	1
Niuean/Samoa	1	1
New Zealand	85	73
Samoan	3	3
South African	1	1
Sri Lankan	1	1
Tongan	3	3
Missing data	1	1
Total	117	100

Attempts were also made to insure an ethnically diverse sample, which again was intended to approximate the New Zealand population. Table 6 reports the ethnicities that people identified with. The majority of focus group participants (63%) identified themselves as New Zealand European. Other groups that featured prominently in the sample were Pacific Islanders and Asians, each comprising nine per cent. Eight per cent of respondents were New Zealand Maori and a further six per cent identified themselves as "Other European." Three per cent of the sample opted not to indicate their ethnicity.

Table 6 Ethnicity

	Frequency	Per cent
NZ Maori	9	8
NZ European	74	63
Other European	7	6
Pacific Islands	11	9
Asian	10	9
Indian	2	2
Other (Sri Lankan)	1	1
Missing data	3	3
Total	117	100

The majority of focus group participants (70%) were born in New Zealand as illustrated in Table 7. Twenty-seven per cent of the remaining participants were born overseas. Of the foreign born participants the most frequently cited locations were: the South Pacific, England and China (8%, 6% and 4% respectively). Three percent of the sample did not to indicate their place of birth.

Table 7 Country of Birth

	Frequency	Per cent
Burma	1	1
China	5	4
England	7	6
Hong Kong	1	1
India	1	1
Indonesia	1	1
Malaysia	1	1
Northern Ireland	1	1
NZ	82	70
Philippines	1	1
S Pacific	9	8
South Africa	1	1
Sri Lanka	1	1
USA	1	1
Missing	4	3
Total	117	100

Information on place of birth was also use to determine if participants had migrated either nationally or internationally in their lifetime. Participants were asked to indicate the city or town they were born in and that information was compared to the location where the focus group occurred. Sixty-six per cent of the sample was living in a different area than they were born in and twenty-seven per cent of respondents were living in the same area that they were born in.

Place of birth information was also used to determine if participants were born in an urban or rural place. The majority of participants (47%) were born in urban places, 32 per cent were born in towns, and 14 per cent were born in rural places.

Table 8 reports the employment status of the focus group participants. Thirty-six per cent of respondents reported being employed full-time, 16 per cent were self-employed and 15 per cent were employed part-time. Collectively then, 67 per cent of respondents were employed. Thirteen per cent of respondents were students, nine per cent were retired and 4 per cent were full time homemakers. Three per cent of the sample was on a benefit of some type and one per cent of the sample was unemployed. Finally 3 three per cent of the sample did not indicate their employment status.

Table 8 Employment Status

	Frequency	Per cent
Self Employed	19	16
Full Time	42	36
Part Time	17	15
Retired	11	9
Full Time Homemaker	5	4
Student	15	13
Unemployed	1	1
Other Beneficiary	3	3
Missing	4	3
Total	117	100

Participants were employed in a wide range of occupations ranging from general labourers to trades people, scientists, medical professionals, farmers and teachers. These occupations have been coded into simplified categories and are presented in Table 9.

A substantial proportion (37%) of the sample failed to answer the question on occupation. The most frequently cited occupational category was sales and service with 12 per cent of the sample working in that area. Eleven per cent of the sample worked as business professionals and ten per cent worked in the education system. Science and Medical professionals comprised eight per cent of the sample, farmers six per cent, labourers five per cent and students and trade professionals four per cent. The ‘other’ category, which contains the final three per cent, is comprised of a police officer, fashion designer and church minister.

Table 9 Occupational Categories

	Frequency	Per cent
Business professional	13	11
Labourer	6	5
Trades person	5	4
Farmer	7	6
Educator	12	10
Science or Medical Professional	9	8
Sales and Service	14	12
Student	5	4
Other	3	3
Missing	43	37
Total	117	100

Table 10 reports the income categories that participant reported. A large proportion of respondents (42%) did not answer the income question. The number of missing responses is high due to simple refusal of the question and a failure on behalf of some participants to complete the reverse side of the questionnaire. Of those respondents who did report their income 15 per cent reported earning less than $20,000 per year and an additional 14 per cent reported earning between $21,000 and $30,000 annually. Nine per cent reported earning between $31,000 and $40,000 annually and nine per cent reported earning between $41,000 and $60,000 annually. Seven per cent of respondents reported being in the highest income bracket of $60,000 or more annually. Four per cent of respondents indicated that they did not know their annual personal income.

Table 10 Personal Income Categories

	Frequency	Per cent
Less than $20,000	18	15
$21,000 to $30,000	16	14
$31,000 to $40,000	10	9
$41,000 to $60,000	11	9
$61,000 or more	8	7
Don't know	5	4
Missing	49	42
Total	117	100

The final question on the demographic survey asked respondents to report their highest educational qualification using an open-ended question format.
Table 11 reports the educational level of respondents in broad categories. Thirty-five per cent of respondents neglected to answer this question. Thirty-one per cent of participants reported secondary school educations, 14 per cent reported having polytech training or post secondary certificated and 21 per cent reported being university educated.

Table 11 Highest Level of Education

	Frequency	Percent
Secondary School	36	31
Poly tech or certificate	16	14
University	24	21
Missing	41	35
Total	117	100

In summary then, the participants in the focus groups tended to be married, men and women in their forties with at least one child. The vast majority of participants were New Zealand born people of European descent although efforts were also made to include Asians, Pacific Islanders, and Maori. Most of the participants were employed, and working in a wide variety of occupations. Many respondents were not inclined to indicate their income level but many of those that did reported modest incomes of less than $30,000 annually. Finally many participants also neglected to indicate their level of educational but the majority of those that did reported having secondary school educations.

3.7 Application of the Focus Group Method

Two Phase I focus groups were aimed at revealing a variety of public concerns. Ten to twelve participants approximated a representative sample according to age, gender, ethnicity and socio-economic background. They were presented with a series of exemplars of recent developments in environmental, agricultural and medical biotechnologies that pertained specifically to New Zealand (see Appendix 2). Comments and themes that arose from these two exploratory studies were re-shaped into a focus group guide for Phase II of the study (see Appendix 3 for guide). The general outline of this second phase is recorded below.

In order to ascertain the relevant importance of biotechnology to New Zealanders, we asked participants initially, how they would like to see New Zealand in 20 years time – a question that required them to project into the future. This was succeeded by a question that unpacked their associations with biotechnology; namely, what they understood by the term. Participants were then presented with the MoRST definition, as outlined in Chapter 1, to clarify the term.

After this introductory stage was completed, participants were presented with five examples of new biotechnologies, listed below.

EXEMPLARS

- Methane from sheep's stomach = greenhouse gas → device in stomach releases bacterium → slows down methane production.
- Bacteria from human saliva → throat lozenge → fights harmful infections.
- Potato → synthetic toad gene → antibiotic protects against soft rot.
- Stem cells (5 day old embryo) → person with Alzheimer's → some reversal of condition.
- GM bacterium → helps clean up NZ soil from a toxin produced when DDT breaks down.

These examples had either been recently introduced (BLIS throat guard), existed under controlled experimental conditions (GE potatoes, GM bacterium, device for methane reduction in a sheep's stomach) or were currently in the early stages of experimentation (embryonic stem cell research).

Participants were given ranking sheets and asked to rank the biotechnologies on a scale of 1-5, one being most acceptable and five being least acceptable. They were also asked to write a few notes on their reasoning, in preparation for discussion. Participants were then asked to justify their rankings, a lengthy process that took up half of the time allotted. Nevertheless, this structured approach allowed all participants to have a voice, in contrast with a more open call for discussion. The sheets were then collected and, at a later point, examined to provide useful for data.

The second half of the focus group was more informal, and varied according to the time remaining, the social mix of the group and previous experiences. It focused primarily on two themes identified from the other groups – nature and safety/risk. Participants were introduced to a series of summary statements made by members of the pilot focus groups, and asked to make comments about what people meant by these statements and to what extent they were in agreement. The summary statements were:

- Is a potato with a toad gene in it still a potato? It looks like a potato, but is it?
- I think there is a risk of perverting nature.
- "Even scientists don't know what they don't know".
- I find it creepy when you're moving across animal-human boundaries. It just makes my skin crawl.
- This isn't really much different from what we've been doing before.
- If we are part of nature, then is what we're doing not natural as well?

In three focus groups, participants were also presented with cartoons on various aspects of biotechnology. These cartoons represented in visual format, again, statements that had been made during the pilot groups (see Appendix 4). They were questioned on the meaning of the images and their use of humour.

Finally, participants were presented with more novel biotechnologies such as xenotransplantation, genetic testing, and cloning, and questioned about their relative naturalness and risk/safety.

The focus groups were concluded with two competing statements about the future of biotechnology in New Zealand, again summary statements based on comments from the pilot groups.

New Zealand is known for its innovations. It is the perfect laboratory in which to introduce new biotechnologies, for it's an isolated island with a small, homogeneous population and has no major animal disease. If we distance ourselves from the biotechnology market, it will be our economic downfall.

As an island miles from anywhere else, New Zealand can distance itself from any potential problems that might arise from the use of new biotechnologies. We should remain "clean and green" and go back to working with nature, rather than against it.

3.8 A Reflective Critique

Whilst the focus groups were formatted in a similar fashion, this was adjusted for each group and strongly dependent upon allotted time and group coherence/sociability. This meant that the focus group guide evolved as the discussion groups continued. Indeed, following each session, the moderator and note-taker had a de-briefing about issues such as those listed below:

- Personal involvement in the issues – what role should the discussion leaders take? Should they simply listen, with minimal involvement? Should they correct misinformation? Should they seek to educate the public? How involved should they get when participants' enthusiasm is catching? How much prompting should occur when participants are unresponsive? In the end, the moderator decided to be adaptable to the demands of each group, prompting where necessary but gradually learning not to interfere with the group commentary. Participants testified to finding the focus groups to be an educational experience, without any necessary prompting that was not elicited from their own queries.

- The use of satirical cartoons as a visual stimulus material – were these cartoons anti-science? Were they useful as a means to elicit responses about humour and the macabre? Some concerns were expressed by one note-taker about the cartoons leading the discussion and, as a trial the cartoons were omitted. However, during analysis, the comments that arose from them when they were used seemed extremely relevant to the overall picture of how participants represent their fears in a socially acceptable manner.

- Nelson, as a choice of city, was an addition to the initial six locales selected for focus groups. We chose it due to its reputation as a 'green' and 'environmentally active' city, yet perhaps due to the method of recruiting participants through PTAs, the resultant mix of people were quite unexpected. Rather than encountering a number of anti-GE protestors as we had imagined, the group was quite subdued, even initially cautious as to our intent. What was most surprising, was that two anti-greens were among the group, and only were willing to provide any opinions after deciding that the group was a "safe space" in which to speak.

- There were problems in recruiting Asian participants. Five schools turned us down in the process, relevant reasons primarily being due to language issues with new immigrants who spoke very little English. Eventually, we used an informal contact at Auckland University, who recruited a variety of participants for us. However, as she noted, no Japanese people were willing to participate, even with a financial incentive, and after trying, she was warned against recruiting Koreans, because nobody would be confident enough in their language capabilities to participate. Whilst predominantly Chinese, the range of Asian participants still covered Indonesia, India and Sri Lanka. Furthermore, two translators were present. The major attribute of this

focus group was that some of these participants were well-educated, often scientifically. This, however, led to an interesting and informative debate.

3.9 Data Analysis

The audio data emanating from approximately thirty hours of focus groups was transcribed verbatim. Whilst this produced lengthy transcripts, in focus group methods, the social processes behind the production on meaningful responses is just as valid as individual remarks, which in such cases cannot be taken in isolation, but must be viewed in relationship to the whole context.

Once transcribed, the written data was re-read and loose themes manually deduced from the text. Furthering this, it was then coded using the qualitative data analysis package, NVivo. This process was guided via a word-searching tool in the software, in addition to some of the themes that emerged through manual coding. Emergent themes were varied and included 'nature', safety, risk, uncertainty, the concept of 'playing God', unpredictability and environmental health. From these, we focused specifically on nature, spirituality and clean green image to structure the following sections of this report. By creating such a focus, we avoid the repetition of earlier research in which key themes have already been identified, provide a more in-depth understanding of particular under studied issues, and prevent the report from burgeoning out into an unacceptably long length. This does mean that some data remain unanalysed, but they may be coded at a later time period and used for a specific focus on safety. However, the process of decision-making during the focus groups is covered in a parallel report (Hunt et al., 2003).

Chapter 4
Biotechnology Issues and Meanings

4.1 Introduction

Participants in this study employed a number of factors in their decision making about the acceptability of novel biotechnologies. These factors have been well recorded in the literature outlined, but include personal choice, control, safety, predictability, nature and unforeseen downstream effects. These attitudes and values played out in participants' relationships to biotechnology as a whole, and as a consequence, this chapter attempts to address the following questions. How important was biotechnology to participants when it was plugged into the arena of everyday life? What were the pressing societal concerns with which biotechnology was compared? What initial reactions did participants have when faced with the term? What associations and emotions did biotechnology raise? As a result, the chapter has a twofold focus and explores:

- Environmental, agricultural, medical and other significant issues identified by participants that have a bearing on New Zealand's future.

- Biotechnology – its perceived definition, meanings and associations.

The penultimate section also describes, briefly, some regional and cultural differences in the perception of the risks of biotechnology. However, we begin by exploring the situatedness of biotechnology within the wider arena of public concerns.

4.2 Contemporary Issues Relating to Biotechnology in New Zealand

Whilst novel biotechnologies in New Zealand are the focus of this report, we felt it important to couch this in terms of issues that the public deem to be important. How topical was the issue of biotechnology in the broader social arena? How relevant was it perceived to be as an issue of public concern?

Participants did make some reference to biotechnologies when questioned about their desires for the future of New Zealand. These were predominantly concerns with GE/GM. Nevertheless, there were also references to innovation; New Zealand's reputation for innovation and the potential for building a knowledge economy based on agricultural and scientific expertise.

In the sections that follow, we identify some of the issues and discuss their relationship to biotechnology at the local, national and global levels. Based on focus group responses, these concerns have been grouped into four categories: environment, medicine, agriculture and 'other'.

4.2.1 Environment

> *I think where our future lies is working to our advantage, which is in the natural environment we do have. We don't need to perfect every technological and scientific advance but work in the areas where can actually gain the best advantage.*
> *Male, Auckland*

The majority of participants placed great value in the "clean green" image of New Zealand, an image that we will consider in detail in the succeeding chapter. Namely, they expressed a concern for the quality and health of the environment, and its essential role in the evolution of New Zealand.

Environmental issues were predominantly at the national level, but had a global reach. They manifested within the focus groups as concerns about the sustainability of energy resources, biosecurity, the ozone hole, pollution and degradation, sustainability, preservation/protection and an increasing need for recycling.

The majority of participant concerns centred around pollution and environmental degradation, at a national scale. This was noticeably evident during the focus group held in rural Waimate and was expressed through comments on the ozone hole, "bad" forestry management, the overuse of household cleaners, agricultural runoff and the improper disposal of waste products.

> *If you walk up the main road and count the rubbish that's in the ditch and it's a total lack of pride that makes people throw their crap out of their car and that sort of thing and that could change a bit.*
> *Male, Waimate*

> *As far as the environment goes, I think it needs to be shared; town and country needs to be shared. And the waterways need to be looked after. They said the Upper Taieri's got high phosphate content. Obviously in good years farmers put fertiliser on and chemicals and they do run off.*
> *Male, Waimate*

> *I go to the coast at the present stage and I look to see sea creatures there and they're not there now and I wonder why. And I think it may be some of the run-off that's come off farms and some of the land. And unless we do something about it we're going to get into trouble. So the environment has to be taken care of and we have to pass it on in better order than what it is given to us.*
> *Male, Waimate*

It is interesting to note that these participants also thought that genetic technologies could be used to clean up the degraded environment. We speculate that perhaps there were some linkages between the noticeable concern for environmental issues in Waimate, and participants' willingness to use GM techniques, perhaps for environment use only rather than general applications.

Some participants raised the contentious issue of a "nuclear free" New Zealand; others reinforced the need for renewable energy resources such as wind power in Manawatu. There was a general unease over "waste" and the overuse of packaging and paper, a problem that could be remedied through an emphasis on recycling programmes. These issues revolved around the need for environmental sustainablility in New Zealand, which the following two excerpts highlight.

> *In terms of the environmental management I think it's appalling. I can think of a time when people swam in rivers and drank lots of water that they swam in and you can't do that as much now because of giardiosis and things like that, so I'd like to see a much more sustainable, intense environmental management from*

tourist campsites to how we manage our own waste to responsible product packaging and things like that.
Female, Wellington

A lot of more changes in technology like a move away from a lot of the fossil fuels and more development and changes there. I guess emissions and more progress in terms of fuel cells and alternate energy sources, wind turbines and things like that as opposed to thermal power.
Male, Nelson

Some participants also placed an emphasis on managing our environment for the benefit of future generations. They projected their concerns into the future and thought beyond their own egos. This included comments about sustainable technologies, environmental protection and preservation, prevalent in the Christchurch groups.

As far as the environment is concerned New Zealand does have a wonderful advantage compared with most countries in the world and it does need to be preserved.
Male, Christchurch

I guess I'm a wee bit of a Greenie so I'd like to see New Zealand kept clean and green. Really protect the waterways, the forests and things, the native things. I think that's very important for us.
Female, Christchurch

I think it has to be pro-active preservation and I tend to agree with the whole - what's a sustainable number for the population to enable it to happen? People are arriving to get what we've got and it's slowly disappearing as a result.
Male, Christchurch

Furthering this preservationist attitude, we found that participants (especially in Nelson) had strong feelings about the integrity of biosecurity in New Zealand. There was a definite concern with border-infringement, contamination and the possibility of widespread disaster.

We want to keep out as many of the bugs and pests from overseas 'cos the history in New Zealand, a lot of problems. And especially in what has happened lately.
Male, Nelson

I was going to pick up on the biosecurity. We have to be more vigilant about that. There was a thing on the news this evening four percent detection rate. You know, that's shocking, absolutely shocking. They're only getting four percent of the bugs that are there in those things that they look at. They don't look at everything. So for every four they find, there's 96 little critters come through. And we're already overrun with white tail spiders. I don't want to be overrun with anything else!
Male, Nelson

This concern with biological "invaders" blends into attitudes towards genetically modified organisms, and suggests that public perceptions are coloured both by personal experience of "*aphids and things like that that have crept in*" and informed by media coverage of biosecurity issues.

4.2.2 Medicine

The health service and medical practices were dominated, not by concerns with new innovations and the need for novel treatments, but with a twofold emphasis on prevention/primary care and support for new medical professionals (and scientists in general), whether it be financial or employment. These concerns were expressed at both the national and local levels.

Whilst many participants emphasised equal access to primary care, it was the lower income Pacific Island community in Auckland who expressed this as their most pressing concern for the future of New Zealand.

> *What I would like to see is big improvement in health over 20 years, full stop, 'cos it's not good at all. We have to send people over to Aussie and things like that, you know…My main concern is health for Pacific Islanders. Everybody getting equal status and everything.*
> *Female Pacific Islander, Auckland*

> *In terms of medical technology I'm a great proponent of primary health care. I think there needs to be a social consciousness shift in how we view health. What it is; what we are entitled to and what we feel we are entitled to. But also to balance that off with using medical technology so the advantages are to patient outcomes rather than running juggernauts of institutions like District Health Boards.*
> *Female, Wellington*

This pressing concern with access to primary healthcare was coupled with an emphasis on the importance of a healthy population to New Zealand society. Disease prevention was preferred, rather than simply solving new problems with technological fixes that one participant described as "*the ambulance at the bottom of a cliff approach*".

This desire was supported by requests for "*preventative medicine*", a reduction in antibiotic usage, financially accessible exercise programmes for children, youth and "*older people*" and the reinforcement of healthy eating habits in educational institutions. Moreover, many participants in Waimate advocated for the freedom to use all types of medicine, including homeopathic. One participant related a story of a personal friend who was unable to prescribe homeopathic medicines for fear of losing his medical license. This, he linked to an ethos of government "*suppression*", feeling that it was tied into the economic clout of pharmaceutical companies.

At the other extreme, some participants advocated the need for more support of suitably qualified medical personnel and researchers, whether they were New Zealand natives or new immigrants. Indeed, one participant suggested there was a "*picky resistance*" to the employment of these well qualified, but undervalued immigrants. Others focused more on the loss of New Zealand nationals.

> *Coming from a scientific background, I see the huge lack of funding and the huge lack of opportunities for graduates coming through the system and armed with this knowledge but no opening there for them. You know the brilliant ideas that are coming out of research labs - for example lipronol extracts from green-lipped*

mussels as a cure for cancer. Those sorts of things need to be looked at seriously and really pushed along.
Female, Nelson

I'd like to see us try to keep our nurses and doctors - what can we do to keep our training medical people and keep them here and their skills and expertise.
Male, Christchurch

As these excerpts imply, there was a general feeling that New Zealand was the victim of a brain drain, with valuable medical expertise being forced to move overseas due to lack of jobs, funding and student debts. Furthermore, participants expressed an urgent need for financial input into the health service. Moreover, this money should where it was needed rather than being "*wasted by corporate cars and trips overseas, buildings and all the other things that the health do*". "Corporate responsibility" was emphasised, and a desire for New Zealand to be a world leader in medicine and science, via the export of local knowledge.

I want it to be up-front and leading in the sciences and medical field. Huge potential in the country that needs to be tapped and kept within New Zealand, and use that as our export. The product of its people as the export.
Male, Auckland

4.2.3 Agriculture

Agricultural concerns were top of the agenda for the majority of focus group participants. For many Kiwis, farmers were perceived as being the economic "backbone" of the country. Not surprisingly, participants were well-informed and concerned about the future of New Zealand's agriculturally-based economy, in terms of its viability, diversity, use of biotechnology and place in the global marketplace. More specific issues were the importance of animal welfare, "safe" food production, sustainable agriculture, and a debate over organic farming versus genetic engineering, but one that was not as polarised as expected. These debates occurred at the local, national and global levels.

Among New Zealanders there was a strong recognition that in order to maintain their status as a world leader in agriculture, progress must be embraced. This might involve an increase in diversification and specialisation of products/techniques or the more general expansion of agriculture.

We're going to need to keep diversifying simply to survive in the world. We're a small nation. We've got to find niche markets and we have to get our products to those niche markets otherwise other people will do it before us. They'll be quicker and they'll be smarter than what we are. You can look around the world and you can see some of the nations that are doing that - trying to do that already.
Male, Waimate

[New Zealand has] got very big dairy market, but it hasn't exploited it much. It should do well in that. And another thing, I feel, I may be wrong - just correct me. It has got a good sheep – wool, you know? [Laughter]. So, I think it can do a lot in wool market if it is taken up seriously. It is good but it's not much. You can do much more, better.
Asian female, Auckland

I think I'm like a lot of the others. There's no point in exporting raw product en masse because we're such a small exporter world wide but it's of such a big portion for us that we should be adding value to the product because that helps the commercial and the industrial side of it.
Male, Christchurch

Interestingly, from these comments evolved a representation of New Zealand as a small island in a big market. They were often based on comparisons with similar countries.

Whilst there was a definite concern about the future of New Zealand agriculture, Waimate residents expressed a desire for this future to be sustainable. This was both in terms of farm size (resisting the temptation of succumbing to the trend towards large scale production) and the widespread use of pesticides and herbicides on farmland.

And the family farm has been shown as the best unit that actually looks after the land… I'd just like to see people twenty years time being New Zealanders and in the true spirit and sharing and caring and leaving the land better than they found it.
Male, Waimate

We use a reasonable amount of chemical which I'd very much like to get away from - not quite sure how to do it and maintain viability, so sort of stuck in a bit of a trap there.
Male, Waimate

For some participants, the use of biotechnologies such as genetic engineering offered a means of escape from the excessive use of chemicals on the land. This view was primarily emergent among Waimate farmers, although a favourable response to GE also occurred among some members of the Asian community in Auckland.

I think in food production we've got to get away from spray technologies but as far as I'm concerned the only way to do that is with GE technology. GE is the way of the future. NZ has got to be up there with it or we slip behind in food production in all agricultural production. I mean GE technology has been with us for probably about 30 or 40 years. We've been growing GE grasses for at least that long. What they're doing now with GE is they're advancing it to the point where we will probably be able to dispense with sprays in a lot of ways, and possibly even in the future we may be able to dispense with some of the fertilisers that we are pouring on the ground. And that's GE in the future, I would think.
Male, Waimate

I fully agree with genetic engineering being the future. I think that the big push for organic farming at the moment is head in the sand stuff and it's inefficient production and not good for the world as a whole.
Male, Waimate

Motives for this pro-GE stance were a concern for the environment, an emphasis on efficient agricultural production (using the land to "*its full potential*") and instating New Zealand as a "*world leader*" in agricultural biotechnology.

Some members of the Asian community saw New Zealand as lagging behind in the uptake of new biotechnologies. Yet, similarly to the Waimate farmers, participants thought that the country did have the potential to change this perceived weakness into a strength.

> *His opinion is that generally the new technology is in NZ not well developed...[But, the participant] feels NZ should be in the leading position in the world. The competition in the world is quite - in such a competition pressure, although NZ is a small country it should be able to lead the way in some fields.*
> *Asian male (through translator), Auckland*

> *I migrated here because my husband got a job here and I heard before that New Zealand is a little restricted as far as acceptance of new genetic and gene sort of concepts there, and whenever we are talking about these technologies one things is that we are exploiting nature although I am into the field…You cannot do research without exploiting.*
> *Asian female, Auckland*

The first participant cited above based his critique on the "*successful*" and "*safe*" use of GE plants in China; the second was a geneticist. Whilst they were not alone in their pro-GE stance, other people were more modest in their approach to the widespread use of agricultural biotechnologies, and like the Royal Commission report, applied a "precautionary principle".

> *I think there definitely should be some brakes on what is allowed out in the field in the way of research because I don't think it's a good idea to interfere into nature too much.*
> *Female, Christchurch*

> *I just think we'd like to stay away from GE in the main food production areas but I don't mind them, like for example ryegrass. They are able to now switch ryegrass - the drought resistant ryegrass – on, without splicing genes or anything else - just a matter of turning one gene on or off.*
> *Male, Waimate*

This precautionary view was supplanted somewhat by a focus on the well-known slogan "*GE free New Zealand*", a slogan symptomatic of the polarised debate on genetically modified organisms. Unlike the "pro-GE" stance, this perspective was consistent across the country and not focused in any single population group.

> *As far as food production goes I think we remain GE free. I don't agree with genetic engineering. I think there's a lot of cover-ups that go on. I think we need to be particularly vigilant about that.*
> *Female, Wellington*

> *Before coming to New Zealand my idea of New Zealand is that New Zealand is a green and clean country and that's why I move here - like you. And I think in 20 years New Zealand should stay the way it is right now because if you use something like genetic modification it's like what's happening in the States and in Canada and I don't think that's a good idea.*
> *Asian male, Auckland*

> *My picture of NZ has always been associated with the source of food - particularly with the dairy. So I, in as much as I want NZ to succeed in industries*

like all other first world countries, I still wish to see that the country remains safe in terms of source of food. Safe in the sense of we know that they have not been manipulated on one way or another and that the environment from which this food came from is clean and safe.
Asian female, Auckland

Apprehension about the advent of GE was widespread and focused on "*cover-ups*", the threat to New Zealand's "*clean green image*", and the issue of food safety. In particular, one participant in Dunedin expressed a very strong opinion about artificial fertilisers "*killing the soil*", saying that said he would like "*very tight reins on genetic engineering*". Other participants drew the focus away from genetic engineering itself and preferred to advocate for organic agriculture in New Zealand.

Get a spade and dig a vege garden and grow your own. Forget about the spray. Go organic and just eat properly and your health will improve.
Male, Waimate

I guess, I'm quite a proponent for NZ using the advantage of distance from anywhere else in the world to promote and develop organic farming and organic agriculture.
Female, Wellington

I guess I like the thought of trying to keep things organic. I think there's a real market for that here and worldwide and I think that's a good thing - to really concentrate on that as a main area.
Female, Christchurch

These comments on organic farming range from the highly individualistic, to an emphasis on national and global expansion where New Zealand could tap into a niche market that is perceived to be expanding in the wake of GE products.

This initial split between the use of GE and organic agriculture continued throughout the focus group discussions and whilst it fostered a number of interesting debates, it did not often resolve, except in odd cases where participants thought GM and organic could co-exist.

4.2.4 Other Public Concerns

There were a number of other concerns that participants brought up during the introductory stage of the focus groups. It is interesting to note that these concerns were much more basic - shelter, safety, an increase in cultural diversity, education, a stable economy and economic development for New Zealand. We briefly outline them, below.

In the area of housing, one Wellington woman expressed a "*need to focus on people, like the old people's homes, residential care and the way that they're charging, where it's just exorbitant*". Another participant suggested that cheaper housing in central Otago was required.

Most of the concerns over education came from members of the Pacific Island community in Auckland. Participants saw education as a way to lift their children into a higher economic status, to gain meaningful employment and to discipline them for later life. There was a particular concern among community members with children who "*dropped out*" of school.

Whilst some participants focused on biotechnology as the paving stone to economic development in New Zealand, members of the Asian community in Auckland emphasised other forms of industry. A general consensus was to move away from primary production, via a thrust towards Information Technology (IT), which would be a useful product to market in spite of New Zealand's geographical isolation from the global marketplace.

> *Not heavy industry based but at least electronically; information technology. I think we've been talking about countries of similar size around the world, like Ireland, Europe, Finland, North Europe, Singapore. The other thing is we're not so much connected geographically with other countries so this isolation will play a role in there - meaning you cannot get quick access to resources, manpower, all the other things that you can get with other countries if you live next door to each other. So, probably telecommunications or IT business will be a direction to move in. It's probably very much like a Singapore model in a way - not so much heavy industry around.*
> *Asian male, Auckland*

Based on models suggested by similar profiled countries, this focus upon IT reflected a more general concern with moving to "*high value*" or "*value added*" products. This might include motorcars, pharmaceuticals, electronics, or biotechnology, but would place a direct emphasis on innovation and investment within New Zealand.

Overall, biotechnology was little referenced as an issue evoked by images of the future of New Zealand. Perhaps this was because it was not part of what participants called "everyday talk"? Focus group participants were more concerned with root issues such as access to healthcare, housing and education. However, when biotechnology did enter public discourse, it was filtered through debates in agriculture and the New Zealand economy. But if it is so under referenced, what do participants understand by its meaning? How do they relate to it?

4.3 Meanings of Biotechnology

In official definitions, biotechnology is the use of living organisms to make products and solve problems. But what does it mean to members of the New Zealand public? How is the term translated into everyday life? This section comprises a brief overview that records the scope of participants' respective knowledge, prior to any learning that may have occurred during discussion.

The majority of participants were able to ascertain the melding of biology and technology, with comments such as "*applied biology*", "*using technology*" and "*biological technology*", or more interestingly, "*cultural management*" and "*carbon based*". More concisely, some scientifically-minded participants managed to couch it in terms of our more standardised definition: the use of living organisms to make products and solve problems.

> *I think that biotechnology is the use of living things, whether they be in the state they were in when we were born or an adapted state to give us a gain or a benefit in whatever it is we are trying to achieve.*
> *Male, Waimate*

> *Those sorts of things have more of a molecular base to them like DNA. I also think of it as investigating other organisms for looking at potential cures that are already being manufactured within that organism and that you don't get elsewhere. So not necessarily involving any engineering or DNA but just bringing*

out how genes work and how proteins produce too. In a word? Finding out how genes operate.
Female, Nelson

Participants in the focus group of Pacific Islanders were much less knowledgeable, or were less willing to admit knowledge of what biotechnology was. Many comments were reduced to a very literal interpretation of the word or remarks about very loose associations such as "*medical term – to do with the body*" or "*technology. Something to do with the way things work. A computer, technicians – how it works. Mechanics, machines*".

Male 1: They're two things - bio and technology - two different things. Technologies to do with two different cultures.
Moderator: Two different cultures? Different?
Male 1: Ideas, identities.
Pacific Islanders Focus Group, Auckland

These comments touch upon a number of popular misunderstandings of what constitutes biotechnology: "*nuclear warfare, increase in power of the damage that can cause*", "*recycling or composting*", "*chemicals*" or "*looking after endangered species*". These misunderstandings are extremely relevant, because taken as a composite, they all link biotechnology to discourses emanating from the environmental crisis.

As the focus groups progressed, the moderator began to divide participants responses visually, into two emergent categories. This first category, definitions was coupled with a second category, examples. These two categories summarised the manner in which different people understood and categorized 'biotechnology' – as an abstract term, or through experiential examples.

Among the examples people referred to were "*manufacturing artificial medicines*", "*cheese*", "*bread-making*", "*the production of insulin*", "*cloning (Dolly/Nelly the sheep)*", "*geno-typing*", "*mice with ears growing on their backs*", "*painted apple moths*", "*square tomatoes*", "*milk production for research into cures for MS*", "*HIV vaccine*", "*pig's valves for people's hearts*", "*A milk or B milk*", "*penicillin*", "*genome project*" and "*IVF*". These examples were wide-ranging and covered the spatial and temporal breadth of biotechnology. However, it is worth noting that specific focus group participants, such as the rural township of Waimate had more in-depth knowledge than others and were able to expand on certain "*buzzwords*".

Interestingly, many participants responded with what one Christchurch woman called questions, rather than definitive answers, reflecting the uncertainty many people feel about their understandings and more importantly, the validity of these understandings.

Are we including cloning in this?
Male, Auckland

So, when they're growing all those human parts on the top of the mice and the rats that's biotechnology?
Female, Waipukurau

This is probably stupid but bio; I always think of washing powders and things like that so skin and things like that.
Female, Wellington

Although questions such as these ensued, many participants confidently equated biotechnology with genetic engineering and genetic modification. These terms often were the first examples to be verbalized by participants, who were predominantly male, or Pacific Islander women. The parallel came in statements that played on the word "*obvious*": "*the obvious one's genetic engineering, I guess*" or "*GE's the obvious*".

The discussions that followed on biotechnology can be categorized into a number of subjective themes that go beyond simple definitions and examples. The term "biotechnology" is an emotionally charged one, for most participants. We deal with some of these themes below.

4.3.1 Secret Science, Men in White Coats

Not surprisingly, biotechnology was associated with science – laboratories and experimentation. References were made to products "*made in the lab*", "*a lot of experiments*" and "*white coats*", extending out from the lab into the field, through "*trials all over the place*". Some more detailed comments are outlined below, many of which hint at "science fictions" (Fitzgerald and Campbell, 2001) and "Frankenscience".

> *Male: There's also things like vat growing, what do you call it? Basically, with medicine, how they're growing limbs and things outside of bodies. That's not necessarily genetic engineering. It's basically, growing something that doesn't need a body, so they've just got all the right sort of environment to [pauses].*
> *Moderator: What examples do you know of that?*
> *Male: Like growing like an ear on a mouse; just the obvious things like that.*
> *Focus Group, Dunedin*

> *And they doubted it very much because to get Dolly, there was something like 100 or 200 attempts or something. So it wasn't as straightforward as it seemed.*
> *Female, Dunedin*

These excerpts point to the experimental and messy nature of real science. In the small space of the laboratory (as a microcosm for the world at large), participants suggested that biotechnology operated on the micro, rather than macro-level, that is, the level of "cellular activity" or "something new, something small". This was expressed more succinctly by a science graduate from Nelson.

> *I think it sees more of a shift from things from a macro-level, which we've been historically; well just in the recent part - used to investigate things at like a micro-level. So you're looking at things at a totally different scale so as opposed to organisms you're looking deeper and going further into the theory - what makes that organism as opposed to looking at it as a whole.*
> *Female, Nelson*

Biotechnology was perceived to operate at a level that was invisible to the naked eye, and thus requires the instruments and extended sensory systems of science in order to operate (Beck, 1992). The scale level of both our perception and operation has been considerably magnified. Yet, this magnification was perceived to occur "*behind closed doors*". The private space afforded by the laboratory, and the enhanced vision offered by the microscope, were viewed as secret spaces by some participants.

Limited access to public. If you try to go into Crop and Research, its doors, its swipe cards, its. No access.
Male, Christchurch

Male 1: Knowing exactly what they mean by biotechnology and what they mean by GE and what they mean by some of the stuff that goes on behind closed doors. We hear sort of jargon from time to time, but we don't really know what it is.
Male 2: 'Cos often you just get the finished product produced for the world - like remember the sheep that were suddenly cloned. [All: Dolly]. It just suddenly arrived and then we talked about it. So that, what's going on behind closed doors, we don't often know until much later.
Focus Group, Christchurch

The secrecy of science was thus emphasised by black box products that filtered into supermarkets. They concealed a terrible history that lay undefined, but one that was questioned at the political level, with references to government cover-ups and a general lack of communication about new biotechnologies and their safety issues. Participants felt a need to be informed of the processes involved in constructing new biotechnologies, rather than just becoming an experimental end-user of the final product. This was particularly true of the Corngate incident, where participants suggested that "*The Government is trying to cover it…and they tried to destroy it*" or there were "*arguments that the government had known before it was made public*". However, as another participant pointed out, "W*ith biotechnology, so much of the information is commercially sensitive right now…government trying to keep things tight, the companies developing these products; its their commercial advantage whatever that might be*". "*Patenting*" and "*intellectual property*" play a significant role in propagating secrecy, and in turn an atmosphere of distrust and suspicion among participants.

Amidst the rhetoric of government conspiracies, some participants did have an awareness of the double bind between secrecy and disclosure in a competitive market. Namely, that biotechnology companies are bound to secrecy until they obtain a patent for their product, and hence establish ownership and its associated rights. Whilst one ideal that was mentioned would be a concrete arena where people could go and see scientists at work, other people acknowledged that there was a danger that other companies might steal ideas, methods and final products.

4.3.2 Perversion or Progress?

Coinciding with the emphasis on laboratories was a focus upon the "*synthetic*", as opposed to the "*natural*". Laboratories were associated with the making of artificial organisms and products.

I'm not sure if it's a term or not, but basically "stuffing". Its where you get stuff and you put it into products, so its not necessarily genetic engineering. Its basically putting things like extra vitamins and proteins and things, additives into fruit to make it better. Not genetic engineering, where actually changing it the more it actually grows.
Male, Dunedin

I think like for instance, natural resources. Out of biotechnology come other products, which aren't necessarily considered natural, so maybe unnatural products.
Female, Dunedin

Whilst the products of biotechnology were considered to be artificial or unnatural by some participants, others saw them as improving on nature: "*I think of diseases and viruses and medication, you know improving what's available for people in terms of healing*", "*selecting traits and things like that*", "*they inject people for nerves and stuff like that to help them regenerate or whatever*".

Again, we found references to science fiction; this time the "*bionic man*" and the genetic evolution of a human race designed by the human race. Indeed, whilst biotechnology was perceived as unnatural by many participants, there was some support for idea that biotechnology could improve on nature.

Thus, for some people, biotechnology was simply using our scientific knowledge of the world to improve it. Attitudes and values about the role of biotechnology were diverse and appear to take three standpoints: biotechnology as interference (anti), biotechnology as change (neutral) and biotechnology as progress (pro).

When biotechnology was associated with change or movement through time, there was some acceptance that this was "normal". Nevertheless, paralleling other reports, emphasis was placed on "future shock" – that this change was occurring too rapidly for psychological adaptation to it: "*I think society and people are more comfortable with what they are used to…. Society needs or prefers to keep at the present, not to change things*"; "*how fast we are moving, even for a small population – a small country – we are moving really, really fast*". One participant drew out an age differentiation in people's ability to accept rapid change.

Well a difference in view, eh? The later generation prefer going with the wind. I mean, go with the change. But the older generation seems to stand back and go, "Ahh, it's a bit too fast- all these changes." It tends to take time for them to absorb it…older people seem to try to stand back and take it as they go but the new generation just pick it up and go.
Pacific Islander Male, Onehunga

The acceptance of change was perceived as the ability to adapt to rapid cultural and scientific evolution, a quality that was seen by many as diminishing with age. Thus, inter-generational differences were seen to play a huge role in understanding and more importantly, accepting the changes wrought by new biotechnologies.

However, change can also be perceived as tampering with the unknown: "*part of me sees it as almost interference…if it's not broken, why fix it*?" or "*change…what can come out of playing around with chemicals and genetic engineering in a sense of attitude, ways of life and the effects it will have, which is again, quite scary*".

One older male felt even more strongly about this interference and repeatedly referred to the metaphoric raping of a gendered landscape and its associated processes. For him, interference occurred when what was once "*genuine*" became defiled.

Production of beer has been raped over the years. In the old days you had genuine beer made from hops. They pump other stuff into it as well as hops and I

believe they also pump a little something into there that makes you want to drink even more [laughter]. That's a dangerous thing, I feel.
Older Male, Dunedin

Although this participant saw this interference as "*dangerous*", other participants saw biotechnology as a measure of societal and cultural progress, with the evolution of "*whole new concepts of things*" and "*expanding out*" to "*go forward*".

The cutting edge of research that we need to move forward in our biotechnology is a sort of a field that we need to be developing rapidly in order to cope with our daily lives.
Female, Nelson

Development, which to me means positive progress, and producing more for the same effort you might say… I imagine with it would come better health because of better products. Look at some of the things we've had such as fluoride in water. There's children reaching adulthood with no fillings - that sort of thing, with a chemical we're told is a poison.
Male, Dunedin

These participants were aware of the economic and social benefits that a biotechnology industry could provide to New Zealand, and reflected upon it through a more positive framework.

As these excerpts suggest, biotechnology was associated with progressiveness, "*being needed*", "*expansiveness*" and morality. Furthermore, with an economic slant, the importance of innovations for New Zealand's international reputation in a competitive global marketplace was also stressed with a reference to the existence of "*intellectually recognised centres*" such as Lincoln and Massey.

On the more cautious level, one Waimate woman brought up the shadow side of progress; that is, progress for whom? She said, "*I think progress. That's without saying, but what's important's the type of progress, whether it's beneficial for all or just a small few*". Who this small few were was a concern with other participants. Would an obsession with economic gain supersede morality and ethics. On the other hand, participants acknowledged that New Zealand and particular corporate interests have a considerable amount to gain from investment in biotechnology. This was associated with "*high expectations*", "*great wealth*, *breakthroughs*" and the "*money of the future*".

However, for some participants, the creation of wealth was perceived to be at the expense of disturbing the environment. This dichotomy was perceived as unacceptable, particularly by one Maori woman.

And the question is, at what expense? That's the question. Like, so you want more money but at what expense? At the expense of the land dying; at the expense of natural resources being depleted. I mean like, money. All right, I like money. But if you think a bit further about where you're going to be in ten years time - no more trees, no more land to grow stuff on. Where are you going to get your money then?
Maori Female, Dunedin

Whilst for this group, the equation of biotechnology with economic gain was seen unfavourably, one young male in Dunedin revealed his understanding of this dilemma. This understanding was that cultural values held New Zealanders back from competing in world markets.

> *We seem to have an awful culture in our country that somehow money and profit are bad. I don't know where it's come from. Whether it's our inherent tall poppiness. We like to chop people off at the knees, you know? Money's bad. Everybody should be on the same playing field. But there is an inherent culture in this country that seems to think that money is bad, profit is bad, winning too much is bad - unless it is on the sports field.*
> *Male, Dunedin*

Although this perspective is interesting, environmental issues are not generally reconcilable with economic growth. Environmental concerns loom large in the public imagination and society has a long-convoluted history of economic gain through environmental destruction. But negative associations with economic wealth and status can also hold back "progress".

4.4 Uniformity and Difference

Like the PABE report, there was an outstanding cohesion of responses to the biotechnology issues presented to participants across the country. Similarities were primarily about the risks identified and concerns raised, rather than their impact on participants during decision-making, which was fairly individualised (see our parallel report (Hunt et al., 2003)). However, there were a number of notable regional and cultural differences in risk perception, which we briefly outline. We do this first to emphasise some important distinctions and second so that the overall report shows that there are major points of similarity among the findings.

4.4.1 Rural-Urban Differences

During the focus groups, we observed marked knowledge differences between participants from urban areas as opposed to those from rural locales. Notably, the latter appeared to be more knowledgeable, and less anxious about new biotechnologies such as genetic engineering. These differences in awareness and knowledge have crucial impacts on risk perception and attitudes to biotechnology, especially genetic engineering. For instance, members of the farming community focused upon the role of the soil as fundamentally important to growth and life. They consistently favoured the GM bacterium that promised to clean up DDE contamination, regardless of its status as "unnatural" to other participants. Their knowledge of GE was fairly reliable and well researched, and, as users of new agricultural technologies, farmers had purposely educated themselves about risk and benefits.

In contrast to urban participants, rural people were also more vocal and their knowledge was mediated by local social interactions. Participants often finished others' statements so that the transcript was in effect a long babble of voices. This was in contrast to the character of the urban focus groups, which were dominated by monologues.

4.4.2 Cross-cultural Differences

The second noticeable difference between groups was cross-cultural. This emerged most prominently during the focus group with Pacific Islanders in Onehunga, Auckland. Onehunga is one of the areas of the city with the lowest socio-economic slice of society – mainly islanders. Within the group, this was reflected in a range of lower-income occupations. Without making unwarranted correlations, the main striking factor in this group was the distinct lack of knowledge and understanding about current biotechnologies. This emerged consistently throughout discussion. However, there is another side to this account, and that was explained by the cultural conditioning of the group. It eventually emerged that three or four people did have some pertinent knowledge about biotechnology, but this was carefully guarded, sporadically emerging throughout the discussion. Whilst these claims to knowledge were carefully interspersed, others were more guarded; others still (namely the two elder members of the group) were often unable to express themselves in a way that two researchers of Western-European origin could readily comprehend.

Nevertheless, whilst participants only equated GE (especially Corngate) with biotechnology, they saw it as "*two different cultures coming together*", were aware of its economic potential ("*money of the future*") and links to the human body (the biology side of the equation). Most surprisingly, during the ranking section, there were absolutely no references made to nature, the natural or unnatural, in direct contrast to other groups. Yet when the topic was introduced in the latter part of the discussion, participants warmed to the idea and contributed to the understanding of a nature bound by tradition, which is discussed in the next chapter. They were unanimous in this conception. Interestingly, this lack of reference to nature diffused out into the clean green image of New Zealand that all other focus groups referred to, suggesting that it is a culturally locatable icon. However, with such a small sample size, it was hard to generalize.

The second major cross-cultural differences emerged during the Asian focus group in Auckland. However, it should also be borne in mind, that most of the group had a relatively higher level of education and had an awareness of biological processes. Overall, there was a significant emphasis on progress, but progress guided by a precautionary principal. This manifested early on, with references to the future of New Zealand – hi tech, industrial development, and biotechnology development were all heralded as necessary and desirable for New Zealand. Participants appeared to be less fearful about biotechnology, but the concerns they did have stemmed from the evolvability of micro-organisms such as GM bacterium. There was a concern, however, over food products, and one Chinese student attributed this to the Asian culture being very food-oriented. Whilst he was unable to speculate further on this cultural value, we were able to clarify that it was not related to the social aspects of collective meals.

4.5 Summary

Biotechnology is not a new phenomenon, and includes activities such as brewing and bread making. However, for participants in this study, it was linked to discourses of the environmental crisis, in both accurate interpretations and misunderstandings. It was generally understood, but occasionally confused, with other intertwined issues that involved either biology or technology. More so, biotechnology was equated with genetic engineering. This was perhaps the single area in which participants were confident of the connection. The two were almost synonymous in the public imagination.

Biotechnology was also associated with "*secret science*" and "*men in white coats*", and linked to popular images from science and science fiction, which infiltrated discussions. These images were often referred to with a wry humour as participants discussed the issues at hand. Rather than life-sized processes and products dominating discussion, participants expressed their understandings of biotechnology as something removed from everyday life. Namely, it occurred at a cellular, micro level. Adding to the relative invisibility of biotechnological processes was the lack of access to key institutions, which were like black boxes for participants in this study. The furtive nature of biotechnology bred distrust among focus group members, even though it was acknowledged that patenting rights prevents disclosure.

When participants referred to biotechnologies, a dominant discourse was one of synthetic over natural. References were made to the bionic man and the redesign of the human race and its environment. A question emerged in that are we interfering with nature or improving it? This sparked discussions on biotechnology as change, interference or progress. Some participants felt that change could be too rapid, particularly for older people in society. Moreover, whilst people were aware of the economic benefits of biotechnology, they still felt them to be irreconcilable with environmental concerns. Who benefits from progress?

When it came to the arena of everyday life, biotechnology was not in the forefront of participant's minds. Rather, it was superseded by more basic concerns about education, housing, access to primary healthcare, employment and the economy.

An interesting correlation occurred between environmental concerns and a desire to use GM to clean up previous mistakes. Participants felt the need to clear up New Zealand's environment to correspond to the country's clean green image. In medicine, there was a distinct emphasis on access to primary care; prevention at an early stage was better than technofixes. Participants also focused on the diversity of medicines, and a feeling emerged that New Zealand was losing its medical personnel and scientists due to a lack on investment.

New Zealand was perceived as a world leader (or could be a world leader) in agriculture, and there was a general feeling that it should diversify and expand this asset (although Asians thought it should develop away from primary industry into Hi-Tech). Moreover, there was a push to move away from the overuse of pesticides and agricultural chemicals, and GE was perceived by some as a means to do this. Whilst some participants envisaged a New Zealand in which organic agriculture and GE could co-exist, others pointed out the practical impossibility of this vision.

With this in mind, as a generalization, we can say that in the public view, biotechnology did not necessarily have many positive connotations, particularly with regard to its connections with nature. Nevertheless, the majority of participants attempted to remain open to potential for the new developments with which they were presented.

Chapter 5
Nature, Clean Green New Zealand and Spiritual Values

5.1 Introduction

The term 'nature' is one of the most complex, even confusing words in the English language. With a diverse and contested history that spans numerous lifetimes, many researchers prefer to use the term, 'natures', for it is impossible to reduce this history to one harmonious definition. Such 'natures' are "historically, geographically and socially constructed" (McNaughten and Urry, 1998: 15). Environmental realists see nature purely as a physical entity, a stance that can co-exist with that of environmental idealists, who alternatively focus upon the arguably stable, consistent underlying values that underpin this category. In contrast, environmental instrumentalists are more concerned with the motives that enable people to engage in practices and behaviours towards nature (MacNaghten and Urry, 1998: 1).

We found that perceptions of what constitutes nature/s play a crucial role in how participants determined the acceptability of new biotechnologies. What does a focus on nature tell us about the acceptability of novel biotechnologies, and what do novel biotechnologies tell us about how we view nature? In order to explore this dichotomous question, we provide first a brief summary of recent work on the concept of nature. Whilst such work has spanned numerous texts, our synopsis will predominantly focus upon what we consider to be the two most important contributions in recent years. These contributions will lay the groundwork for answering the questions:

- What is nature?
- How is it historically embedded?
- What impacts does this have on the way people perceive new developments in biotechnology?

The chapter then continues this discussion with a critical look at the related concepts of New Zealand's clean and green image and spirituality, and the impacts these concepts have on public perceptions of novel biotechnologies. Additional questions are:

- What constitutes "clean green" New Zealand?
- What role does this image play in determining which kinds of biotechnologies are relevant for national pride?
- What moral codes does a sense of spirituality imprint on particular groups and what role do they play in decision-making about novel biotechnologies?

We turn now to the theoretical overview of recent theoretical work on the concept of nature.

5.2 Nature/Natures

The term 'nature' has been mapped out into categories that span recent social and cultural evolution. The development of these attitudes are embedded in specific socio-cultural circumstances that McNaghten and Urry (1998) have traced back through time. The 16th and 17th Centuries bore witness to the separation and abstraction of nature, from a life-giving force, to dead matter; from spirit to machine. During this transition period (the Enlightenment), God became detached from a nature that was reduced to a series of laws,

products and conventions – a clockwork universe. In the 18th Century, we encounter the making of natural laws and renewal of nature as an 'original innocence'. It was, however, still generally perceived as complex and sensory, and Descarte's separatism was not altogether accepted. Whilst society attempted to improve upon nature, the polluting by-products of this new industrial emphasis were viewed as inhumane, unjust and 'unnatural'. Later, in the 19th Century, the divisions between nature and society were fleshed out, or 'spatialised' (Shields, 1993), the poles becoming 'wilderness' and 'urban areas. The world was categorized into a pure margin and a polluting centre. Disentangled from everyday life, nature became an entity to be managed and regulated - an object for the tourist gaze (McNaghten and Urry, 1998:11-12). Through time, the apparent division between 'nature' and 'culture' eventually became naturalized and hence accepted as "normal".

However, more recently, proponents for a more all-inclusive nature, have argued that "the complexities of a biological reality, enhanced by the insights of modern ecology and genetics, make drawing the boundary between what is cultural and what is natural almost impossible" (Ellen, 1996:15 in Franklin, 2002:132). Furthermore, Adrian Franklin has aired the view that nature is all around us; the untouched, unsullied nature at the margins is unfamiliar to most urban dwellers. Instead, Franklin suggests that there are "scraps and bits of nature along railway lines, roads, old industrial zones, canal banks and coastal wastes" (2002:4). Nature exists as urban zoos, household pets, allotments, organic foods, herbal medicines and children's playgrounds. In this standpoint, nature is not separate from, us, and never has been.

Not surprisingly, with such a history, as McNaghten and Urry argue, "nature does not simply provide an objective ethics which tells us what to do. It is too ambivalent, contested and culturally paradoxical for that" (1998:3). Although there has clearly been considerable debate on this somewhat contentious topic, for this report, we follow the recent work of Adrian Franklin, and bear in mind the following definition.

> Nature is not for us a concrete reality that may be like this or like that, but an idea or series of ideas which specific people (in specific times and places) use to frame and understand their world (Franklin, 2002:22).

Franklin purposefully utilises this definition, as we will, on the basis that his approach is to understand what nature means to people in everyday life, why different interpretations emerge in particular circumstances and their relationship to social and cultural processes (Franklin, 2002:21). Like McNaghten and Urry, we explore attitudes towards nature that are embedded in everyday life and lead to the development of 'desirable or 'appropriate' natures (1998:3). These 'ideal' natures, we argue, are then compared to the futures offered by novel biotechnologies, and used as a basis from which to determine their acceptability. As a result, we will also examine how people' hopes, fears, concerns and engagement with 'natures' connects to the wider societal concerns of the impact of globalisation on New Zealand and the meaning of this for the development of biotechnology.

In the following sections, we explore the meanings of the various 'natures' to participants, and the ways they impact upon how people draw boundary lines between 'natural and unnatural/artificial' and more so, how these boundary lines impact upon the acceptability of new biotechnologies.

5.2.1 Biotechnology and Nature

Focus group comments suggest that nature and the socially constructed divide between natural and unnatural are two of the key criteria that people use to make value judgments on the acceptance/rejection of novel biotechnologies.

> *We actually think it is unnatural to place such devices in an animal.*
> *Female, Dunedin (comment on device to counter methane production in sheep)*

> *The virus to make female possums infertile is a natural process.*
> *Male, Dunedin (comment on possum fertility virus)*

> *We think its just enhancing a natural human process.*
> *Female, Auckland (comment on BLIS throat lozenge)*

> *It's interesting to note that cloned animals aren't surviving as long as the natural animal.*
> *Male, Waimate (comment on Dolly the sheep)*

A very basic premise we might assume from these comments is that "natural is good/acceptable, unnatural is bad/unacceptable". However, this is a simplistic assumption and as this chapter shows, the issue is far more complex than this. But if participants used the natural/unnatural divide as a means to judge the acceptability of biotechnologies, where did this dichotomy stem from? To answer this, we turn to nature/s and how it was perceived by participants in this study.

To participants, nature was a multi-faceted, somewhat ambivalent construction. It was simultaneously adaptive, a complex ecosystem, dynamic, simplistic, flexible, an agent, a "fighter", interactive, a balancing act, compensating, and an entity that may or may not include humans. These configurations are facets of a quantum nature, concepts that are always in a state of flux, appearing, diminishing and reappearing, in different biotechnology-specific contexts.

We now focus upon a select few of these configurations and their role in the perception of biotechnologies. The five main configurations were 'wise nature', 'traditional nature', 'animated nature', 'balanced nature' and 'human nature'.

5.2.2 Wise Nature

Wise nature was perceived as intrinsically "good" and acts as a moral base from which participants compared any changes that may occur over time and space. People placed great trust in the "wisdom" of nature and used it as a frame of reference for decision-making on the acceptability of novel biotechnologies. Wise nature was ultimately anthropogenic, yet little reference to humans was made by participants, except for morally and physically corrupting its inherent goodness. In the following excerpt, wise nature was used as a guide to determine the acceptability of a non-GM spray to kill grass grubs.

> *Female 1: Where does this bacterium come from?*
> *Notetaker: Well, Bt, it's the same basic species that is used in painted apple moth and all sorts of things. It's a Bacillus thuringiensis. I don't know where it originated.*
> *Female 1: So it's available in nature?*
> *Focus Group, Christchurch*

In this case, knowing that the Bt spray for grass grubs was "*available in nature*" rather than genetically modified, changed its acceptability for this participant. There is an implication here that nature looks after its own: "*Why play around with nature when nature takes care of oneself*?"

If nature was seen as wise and benevolent, unnatural/unacceptable became all that threatened this wisdom for the price of profit.

> *If Mother Nature wanted to do it Mother Nature would have done it years ago and what I see happening is all for short-term gain.*
> *Male, Waimate*

Under this particular conception, wise nature was also seen as "equivocally whole" – there was perfection in nature's imperfection and ultimate creativity. There seemed to be a concern among participants with scientific attempts to "fix" nature. For instance, when it came to protecting a potato from soft rot with a gene modelled on one encountered in a claw toad, we encountered significant resistance to the idea.

> *There's nothing wrong with it at the moment, so why? Its like you don't need to fix it, do you? I mean, if it gets rotten, you throw it into the compost and it's composting, isn't it? You're using it again. I mean, there's nothing wrong with the potato. You just left it too long in the sun or, you know, or not where it should be and it's gone rotten. Put it back into nature.*
> *Female, Dunedin*

Thus, when nature is wise and all-knowing, human attempts to improve on its "morally right design" are perceived as tinkering with the natural order. Later on in this chapter, we explore this in more detail through the lens of spirituality and examine the context of "God's natural order".

However, as participants suggested, "*nature isn't perfect in a lot of ways anyway*" and "*even natural drugs have side effects*". Whilst there was an evident desire to delimit the natural from the unnatural, a small minority of people were wary of the "nature is good", "*not* nature is bad" dichotomy, and the moral and political implications it had for humanity. The benevolence of nature and natural processes was still overruled at times by more emotive, intuitional responses that participants could not always explain: "*[embryonic stem cell research] just doesn't sound right. Even though there's so many people we should be helping, and it is a natural thing*". Although nature was usually perceived as the wise healer, this was not always the case, and other factors in unison could radically alter the acceptability of any particular biotechnology.

5.2.3 Traditional Nature

> *Female 1: Just what will they produce next to clear up the gene bacterium. You know, an ongoing thing.*
> *Female 2: I wonder how we used to get on before? Probably someone thought that's well have this thing because that will help us to get more and then the effects so sometimes I think we forget about looking back into how things used to be, natural.*
> *Focus Group, Dunedin (comments on GM bacterium to clean up DDE contamination).*

What we have termed 'traditional nature' was a nature that pre-existed prior to the birth of participants, or the nature they were aware of in childhood. This was perceived as a nature of time-past; of reminiscence for what once was. In this case, humans were included in its definition, for it was a nature that existed throughout human history. As a consequence, traditional plant breeding techniques could be included in its scope.

Particularly among the Pacific Islanders focus group participants, traditional nature was unequivocally the dominant perception of nature when it was juxtaposed to new biotechnologies. This is best understood through the following comment on embryonic stem cell research.

> *This embryo business that's not part of nature. That's not right, nature. I think most things are not part of nature nowadays. Things have changed. Nature is the original. Things are not the original at the moment. There's been a lot of changes getting here. As we're trying to get back to it as we go on the genetic, what do you call it genetic-free. We're trying to go back to it - this nature. Original things, from the beginning, as if from starting. But now it's not at that.*
> *Male, thirties, Onehunga*

This traditional nature was associated with origins and starting points that could be re-established by moving away from genetic engineering and associated technologies.

For some of the Pacific Islanders, nature became spatialised. Namely, it was fleshed out in the context of another place and time: the islands that these now urban dwellers had originated from. For them, traditional nature was not associated with New Zealand, but with the homeland they still identified with that existed in another space and time.

> *There's much difference; it's a great difference. Before I look at that throat lozenge. We have our own medicals like our own herbs to treat them. It comes out you're using these throat tablets that's from saliva of somebody and it comes out of it. It's different things altogether. If I look back at Island ways. We have our own herbs for different type of sickness, which we still use nowadays. What with this sort of thing coming up with use of body cells and everything mixed up … so there is a great difference between those two things. That's the way I look at it. There is a great difference between those - from now. Before we grow our taro, our cassava, our kumara - no fertiliser. Just put it down and go. When taro comes up, cassava goes in. That's it, no fertiliser. Once the fertiliser comes in growth goes down. That's how it's so dangerous. So there's a great difference there.*
> *Male Pacific Islander, Auckland*

Emergent from discussions with Pacific Islanders, traditional nature was not only rooted in an historical context (the traditional Island ways), but was equated with slow change, rather than the rapidity of contemporary innovations that some participants found too fast. This fast change was comparable to a 'post-modern snap' from traditional agricultural practices, rather than a gradual sea change reminiscent of the continuation of accepted norms. Interestingly, this was particularly true for the progress-oriented Waimate farmers.

Male 1: It's a lot different.
Male 2: It's quite different.
Male 3: It's a major step. It's not just a 'oh, we'll just stick a few genes together'. Nature's never done this before.
Focus Group, Waimate

Thus, it seems that a general perception was that biotechnological innovations, particularly in food production, spelled a radical reinterpretation of traditional agricultural techniques.

One variant on this idea of traditional nature was that it was "pure". This was perhaps epitomised in the media marketing of 100% PURE New Zealand that we discuss later in this chapter. If New Zealand was considered as 100% PURE, nature became almost sanctified, revered and definitely untainted in this construction. The definition takes on an increasing rigidity, because anything that taints this purity becomes "unnatural".

These tightly demarcated boundaries were most apparent in the following discussion on the BLIS throat lozenges. Most participants deemed them 'natural', due to the incorporation of bacteria, harvested from human saliva, into the product. However, one woman probed deeper into this marketing 'illusion', and saw that this 'natural' bacteria would probably be preserved with synthetic chemicals to make up the throat lozenge. Instead, she drew out the purity of 'raw' products that were not tampered with in any way.

Female: Crystallised ginger's got natural antibiotics. You see, the Chinese, they believe that eating onion and ginger and garlic because it's all a la natural. A la natural antibiotics in it.
Moderator: So, do you like the idea of just being natural?
Female: No, no, because I find whatever they use and other chemicals in it lasts long, in that, lolly, and that's why it stays on the shelf and everything whereas ginger and an onion and garlic, natural root crop, which you put in your food and you part cook it. And its still fresh inside you when you eat it and everything, whereas crystallised ginger, even though, they've put sugar in it, a wee bit of sugar to take that strong odour of the ginger, its still natural cos it's the root of the ginger. So it's got natural antibiotics inside you. You're putting something natural inside of your body, rather than putting more chemical in it.
Focus Group, Dunedin

These root crops have a direct, earthy connection with traditional nature and its healing properties that were encompassed in wise nature. They represent pure products, direct from nature's pantry. Thus, when traditional nature was perceived as pure and unsullied, unnatural became everything that perverted this purity.

But I don't see that as natural because I think that people have interfered with it. So when I think natural I think I would go down to the organic place and I'll ask for the organically grown herbs save my time.
Female, Waipukurau

Female1: Things that are unmodified, unchanged.
Female 2: No sprays, chemicals.
Focus Group, Dunedin

Unnatural became equated with human interference with traditional nature, as discussed in the previous chapter. But to what extent was this somewhat revered nature, something that was actually 'naturalised'? Namely, to what extend was it accepted and normalised over time by participants? The following comments that compare xenotransplantation to a biotechnology that transfers the 'good' bacteria in yoghurt to other dairy products are indicative of the extent of this naturalisation of traditional nature.

> *Moderator [Why is the bacterium the most natural?]*
> *Male 1: The second one about the pigs doesn't say anything about GM modification. But it is from another animal to another species, whereas the good bacteria from the yoghurt is a by-product that we've accepted as healthy for years and years and years and I know that bacteria from yoghurt is beneficial in many ways.*
> *Focus Group, Dunedin*

> *Just like people are being able to accept change, societal change, but when they're born they see what nature is and what society is and 50 years later when its moved on…people go "that's wrong, they cant do that", they think that it should be when they were small.*
> *Female, Auckland*

Although people placed faith and a certain level of trust in a traditional nature, it was interesting that many participants did not want to "go back" to working with nature. Rather, their desire was for progress. This was something of a paradox, with tradition and progress both valued, as participants held onto competing subject positions that were contextually brought to the attention of the group to support or refute different biotechnologies.

5.2.4 Animated Nature

Rather than being a physical product that exists external to the self, nature was viewed by some participants as a process. Thus, another construction was a dynamic nature, complex, shifting and most of all, evolving. When participants talked about this nature, they used referents such as "ecosystem" and humans as part of the "food chain"; terms that were embedded into secondary education and popular science.

When animated nature was juxtaposed to biotechnology, what are marketed as "products" to the consumer world (throat lozenge, bacterium, sheep device) were actually perceived as processes themselves, or technologies that altered "natural processes".

Many of these "processes" disguised as "products" were perceived as being "alive", in the sense that genetically engineered organisms could adapt and evolve – they were slippery aberrations of a synthesised nature. For Chris Langton and his contemporaries at the Santa Fe Institute, an *information* dynamics is embedded into living systems, and accordingly, the primary indicator of life is a behaviour based on "a complex dynamics of information" (Langton, 1991, 42). Thus, he re-defined "aliveness" as a system capable of spontaneously organising into entities that have the ability to eat, reproduce and evolve (Horgan, 1995, 107).

In these focus groups, animated nature was perceived by some participants as an organic, evolving system. For these people, harnessing nature and this inherent aliveness was a potentially dangerous issue. For instance, one Maori woman saw the virus to render female possums infertile, as interfering with aliveness: aliveness as the ability to reproduce and

evolve. Consequently, if this inherent right to reproduce was disrupted, we enter the realm of the unnatural.

> *Is that the outcome that we want is for the population to die out? Because there are other options. Like for instance, I would say it's unnatural because everyone's got the right to reproduce, whatever and there are other options, like we treat sheep. We kill them, and you can skin and them and you can use them for meat. So and a while ago I heard people talking about that and how popular the fur was actually. So there are other options. And I wouldn't say it was unnatural.*
> *Maori female, Dunedin*

A sense of fear emanated from these attempts to manipulate life itself. There was a strong recognition that nature was alive and biotechnology was interfering with this aliveness in unpredictable and potentially intractable ways.

> *But, I mean, as much as I want to advance, I think we're really starting to change what we've known what is nature and it could really backfire on us.*
> *Male, Waimate*

Among participants, there was a growing fear that meddling with an animated nature could lead to unpredictable consequences unleashed at local, national and international scale levels.

Some participants also wondered if the favouring of this 'biotechnological fix' was reflective of an inherent laziness to production; an emphasis on product rather than process.

> *All this is about taking the hard work out and just working with the product and not the environment. The environment doesn't do the work anymore. We do, and we do it straight from the product and we don't need any other stuff…I mean, our natural environment also includes how the process of everyday living, the process of growing, the process of working with, the process of eating, things like that. If we want natural clean green, it doesn't include potatoes that have been syringed with toad genes in the lab and multiplied. I don't know what they're doing, but that's what I think of.*
> *Male, Dunedin*

Such comments represent a critique of society as a whole; that biotechnological innovations slot nicely into a culture defined by consumer products, rather than the process of living and dying. Thus, our over-reliance on this biotechnological fix was seen as a sign of laziness and fixation on static end products rather than the process of making them. Indeed, this focus on static products de-animates and compartmentalises nature itself.

Conversely, when participants saw themselves as part of nature, humans were simply speeding up the process of evolution rather than tinkering around in God's image. Thus, one Auckland woman said "*When you start with something that is a natural product, but then to make enough of it go round to satisfy the [unintelligible], you enhance nature. You're doing the same thing, still fiddling with nature to a certain degree to synthesise and make better use of it*". A similar response came from a woman in Waimate when she made a comment on the BLIS throat lozenge: "*I think that there's a wide range of variants in people's saliva…I just felt it's something natural and building on the strengths of individuals, and when we are all different*".

5.2.5 Balanced Nature

Another emphasis was on the "balance of nature", namely, homeostasis. This nature was complex and lay perfectly poised in a state of ecological harmony; it hung "*in the balance*". Everything in the food chain was "in its place" and "unexpected consequences" could occur when its relative stability was disrupted.

This nature relates to dynamic nature, but the emphasis lay on everything being in the right place at the right time. Feedback led to checks and balances in the system. Namely, everything natural had a place, and if it became dis-located, it was checked.

> *Moderator: So you're talking about the 'balance of nature'. What do you mean when you talk about the 'balance of nature'?*
> *Male: Basically the food chain.*
> *Female: Effectively that no one species dominates another.*
> *Focus Group, Christchurch (discussion on possums in New Zealand)*

> *But if we look at natural and nature too. If we're looking between species say, biologically, species protect themselves from inter-species breeding - like monarch butterflies or bird breeds. They have mechanisms in place. The blackbird doesn't hang out with an owl and produce something that is not viable. So, in that sense it may not seem natural to take out a pig's pancreas and put it into a human body for the purpose of producing insulin…People are abhorrent to the use of animal parts in the human body.*
> *Female, Wellington*

In this balanced universe, species define their territory with tight, clearly delineated boundaries, in terms of interbreeding, genetic identity and potential population explosions. Inter-species sexual and hence reproductive relationships do not occur.

If nature hung "*in the balance*", a balance that was perceived as dynamic, dissipative, and yet inherently stable, when new biotechnologies such as GE were theoretically introduced into this balance, they were viewed as "upsetting" or "destabilising" to it.

> *Nature's always basically been in a state of flux. Like the populations go up and down - predator/prey and all that sort of rubbish, sort of thing. But you throw a totally different element into it.*
> *Male, Waimate*

The unexpected, the novel has the power to tip the perceived equilibrium into a state of disharmony and dis-equilibrium. In effect, a stable system could be pushed into a chaotic state, with its resultant unpredictability.

At its most extreme, balanced nature drew on the competitive language of popular Darwinism. Participants emphasised the "*survival of the fittest*", and "*random mutations through experimentation*". In contrast to the above, nature became a warrior who could adapt to any adversities that humans cared to throw in its way.

In a quotation taken straight from the movie, *Jurassic Park*, one male participant said,

Well, nature adapts, doesn't it? Nature adapts to the environment that's placed around it, and we're seeing it now with the introduction of calisi virus in farms, we're seeing the rabbits and hares building up, well, just rabbits, building an immunity to it now, so they're no longer susceptible to something which was an artificial control.
Male, Christchurch

If balanced nature can adapt to human blunders and "*artificial controls*", then some participants thought that it could adapt and overcome the products of genetic engineering. Namely, genetically engineered organisms were developed in the lab, and evolved in a simplified environment, uncoupled to the competitive complexity of the external, "natural" world. As a result, when introduced, whilst they may have competitive advantages in the "field", their survivability when faced with species adapted to adversity appeared questionable to some. Organisms derived through biotechnology were not seen to really have a competitive edge when they left the laboratory.

Moreover, many participants thought that organisms should be allowed to evolve 'naturally' within this competitive framework. This evolution was in part based on the interactions of our immune system to the external environment and its effect on the robustness of our own bodies. Thus, based on knowledge filtering into public spheres, there was a belief among some participants that for immune systems to function effectively, they must be worked, tested and used continuously. This applied not only to human beings, but other organisms.

So if you put a synthetic gene that protects potatoes against soft rot, aren't you reducing that potatoes' own immune system, because you're synthetically doing it for it? And that's akin to giving someone with AIDS, HIV treatment, isn't it. You know, you're boosting up the immune system, artificially.
Male, Christchurch

In particular, there was a fear that antibiotics added to potatoes would subsequently lower human immune systems when they were consumed and absorbed.

When nature was balanced, two main versions of unnatural emerged in discussions:

- The introduction of something "*alien*" to this balance. Namely, unnatural was an entity that was not created within the balanced system of nature. It did not co-evolve with other organisms and hence did not have a competitive edge. The likelihood was that it would either find a niche and flourish or be rapidly out-competed.

- The displacement of something 'natural' (evolved in nature, for example, pig cells) into something else that was 'natural' (evolved in nature, for example, human bodies). Here, unnatural became equated with displacement, for the two biological entities did not evolve in unison. Juxtaposed, the pig cells become what anthropologist, Mary Douglas called, "matter out of place" or pollution (Douglas, 1965). Or as one participant stated, "*The pancreatic cells are a natural product that is being put in an unnatural place*". In this case, the outcome was more uncertain and unpredictable.

5.2.6 Human Nature

All participants agreed that humans held a special position within what we call 'nature'. This position implied a stewardship role which held us accountable for the upkeep of nature and management of the planet for future generations. Thus, participants' worldviews ranged from an emphasis on simple "*planetary management*" to "*responsible' planetary management*", where sustainability was the key to the future of the earth.

> *I see us as a food chain. We are quite dominant. We have control, more control over animals and our natural resources so we have that responsibility and accountability, so I don't think its OK to say we are just part of nature and not replanting, recycling, reusing, composting,*
> *Female, Dunedin*

> *I think that's quite naïve the fact that as humans we need to recognise the position of power we have in nature, we have the power to destroy the whole world within a limit if we really wanted to, whereas the tiger in the jungle doesn't.*
> *Male, Auckland*

The key point about this stewardship role was that it was our special position and superior cognitive ability that made us accountable for our conscious actions towards the planet. Indeed, participants referred to the implicit power relations in this relationship. Whilst humans had the power to destroy the planet, nature also had the power to destroy humans. This perspective was often linked to the notion that humans were alien to the symbiotic relationships of the natural world: namely that "*Nature lives in co-operative competition; with man it seems to live in competitive competition. There's a bit of a difference there*". Whilst nature existed in a form of internal symbiosis, human separation from nature placed us in a combative, rather than co-operative position. But it was sometimes perceived as a battle that humans would lose, particularly when we interfered with natural processes.

> *We're assuming we're apart from the whole of nature basically, the way I see it, and therefore we can do what we like with nature. But in actual fact nature comes back and kicks us in the ass time and time again…But when we think we're the king of the top of the food chain or the top of that we can do anything to nature I think we've got to take another look at ourselves.*
> *Male, Waimate*

Although some participants saw humans as separate from nature, one was particularly extreme in his views that we are instead, part of nature. He used this stance to justify the ongoing production of new biotechnologies.

> *Male: As man is merely in the environment, man is natural in the environment. You know, we came about by virtue of natural processes, if you like.*
> *Female: And you use whatever's available.*
> *Male: Yeah, but we came about by natural process and we live by natural process and heavens we make overhead projectors and tables and so forth by natural processes. At what point does man interaction with his environment become unnatural?*
> *Focus Group, Dunedin*

In this participants view, we *are* nature. Consequently, everything humans do is natural, including the production of biotechnological interventions that are perceived as consciously evolving nature. The same participant carried on:

> *Well I think everything is natural. The fact that humans exist is natural. The fact that we live in buildings and chat in staff rooms and teach our kids is natural, and that's just a natural evolution. And things will keep on evolving and part of human evolution is that we might start playing with genes and start playing with the low level you know, biological makeup and things of this world.*
> *Male, Dunedin*

The idea presented here is that humans are the conscious evolutionary force of the planet, improving nature through the focused management of nature. In this excerpt from the Waipukurau focus group, one woman was convinced that the 'natural' human role was to participate in and further planetary evolution through experimentation and the production of new knowledge. Thus, it is human nature to be inquisitive and to push at the boundaries of the unknown.

> *Female 1: Don't you think it's part of our destiny as the human race that we keep on doing the things we think are right and have faith in human nature to do the right thing and later on it may not be.*
> *Female 2: Can I comment there? If we are part of nature then is what we are doing not natural as well. I think it's natural for the human race we think of ourselves as the most intelligent form of life to keep asking why. And to pursue knowledge in all the fields*
> *Female 3: We're very curious aren't we?*
> *Female 1: And so that's a natural thing to do. It's just a matter of words isn't it? You can convince yourself with any argument if you really try.*
> *Focus group, Waipukurau*

However, as the same woman conceded, the multiplicity of the term 'nature' could be manipulated to justify any actions that humans take, without the need for some form of moral accountability. Namely, if we are natural, everything we do is natural and hence, following wise nature, 'morally good'.

The issue of the human role in nature also led to philosophical discussions on the nature of human nature.

> *Female 1: I think everyone is aiming to make life better generally.*
> *Female 2: I think that's why humans are where we are now. If you didn't have natural inquisitiveness, wish to make things better then we'd still be back in the caves.*
> *Focus Group, Auckland*

Some participants wondered if our curiosity was a natural evolutionary trait; moreover, if we did not possess this trait, would humans still be a primitive species?

This stance was rare, but when the moderator gave participants a paraphrased summary statement of the first participant's words, "*if we are part of nature, then is what we're doing not natural as well?*", it did produce some agreement. The ensuing discussions led to intense

debate on the role of nature and biotechnology – debate that was not always resolved and was fuelled by rhetorical questions to which there were no definitive answers.

- Are human modifications of nature 'unnatural', but those of animals 'natural'?
- Can animals act as agents to alter natural processes?
- How sustainable is the human relationship to nature?
- Are there discernable differences between Maori and Pakeha attitudes to nature and biotechnology?
- How relevant is our naturalness to decision-making about biotechnologies?

These questions hint at what is the final section of this discussion of nature; that is, how did participants draw the boundaries between nature and artifice; natural and unnatural? And what did that mean for their perceptions of novel biotechnologies?

5.2.7 Human, Animal, Plant: Transgressing Boundaries

> *I wonder if the issue is humans versus animals? I wonder if that is actually what is at the crux of it? Is it a human issue? You know, it's that crossing over of bestiality - the mind of the human versus the animal. When should we kind of cross over it? So I wonder if it's not so much a nature-natural thing but a human-animal thing.*
> *Female, Wellington*

The issue of what is human nature draws us to another issue that emerged from the focus groups. Is the deep-rooted reluctance to accept some novel biotechnologies not really dependent on their naturalness, but the infringement of the diminishing boundaries between what is defined as human, animal and plant? Increasingly, with the diffusion of knowledge about the minor genetic differences between humans, animals and plants, the 'specialness' of humans as a species distinct from other animals has correspondingly diminished. Namely, as one participant put it: "*The DNA structure between humans and monkeys is very, very close*".

However, many focus group participants still felt that merging animal cells with human cells was an unnatural act that was difficult to conceptualise.

> *I think it's unnatural to take an animal cell, because that's what you're doing - even if it's an ear or you know.*
> *Focus Group, Waipukurau*

> *Female: It just seems, creepy.*
> *Moderator: Why does it seem creepy?*
> *Female: Just, anything does when it starts mixing humans with animals. I mean, there's an argument for people who are suffering, and in bad health, and if they wanna go that way, that's fine, but yeah, it's just. It's not natural is it? So, in my opinion, it just seems unnatural and it's just hard to get your head around it.*
> *Focus Group, Christchurch*

The sense of creepiness evoked by the process of xenotransplantation manifested physically, rather than verbally, as a sensation that made participants' "*skin crawl*". Indeed, many participants acknowledged that the response to boundary infringement was an emotional, rather than a rational one.

Thus, even in the wake of new found genetic knowledge, focus group participants exhibited a reluctance to merge animal organs and genes with human bodies. This materialised as a feeling of abhorrence. Yet as one discussion brought up: "*But we eat animal material every day – the meat eaters among us. We don't feel that to be abhorrent*". Rather, "*We see that as perfectly natural*". If in everyday life, we (excepting vegetarians and vegans) ingest animal by-products and dress ourselves in animal products, and breathe in air that was exhaled by animals, then why did participants feel so uncomfortable with xenotransplantation? Moreover, why did they also feel uncomfortable with the reproduction of the human form through cloning?

Both biotechnologies were seen to trespass over the boundaries of what was considered to be natural processes, determined by wise nature and played out in balanced, animated nature. But as focus group discussions suggested, are the categories of 'nature', 'naturalness' and 'unnaturalness' really just masks to disguise human abhorrence about what may be the real issue at stake – our identity as human beings?

Nevertheless, another more pressing question emerged from focus group discussions, and that is: was this abhorrence towards animal-human boundaries overarching in their decision-making process? Under what, if any, circumstances would participants be likely to overcome their abhorrence and risk the dissolution of their self-identity by accepting animal cells into their bodies?

Defining xenotransplantation, stem cell research and cloning as 'unnatural' did not always mean that their value was discounted. Rather, when all factors were taken into consideration, perceived abhorrence was often overridden by personal need.

> *It's like the argument to introduce insulin and then take the pancreas of pigs and insert them into diabetic patients so they can produce their own insulin. We could sit around here and say how abhorrent, that is, unless we were a diabetic who daily injected themselves with insulin and lived very real lives.*
> *Female, Wellington*

> *There was work being done on mice with regards to being able to repair damaged spinal chord. Now my [relative] who spent many years in a wheel chair, would have been absolutely thrilled with that. And I reckon he would have gladly grown a tail if it meant he was able to walk again! And it just seems that it would be so precious to not allow these sort of gains to at least be investigated because it's perceived to be unnatural.*
> *Male, Waimate*

It was perceived that personal need would be enough to offset the fear of the potential identity loss provoked by the transplantation of animal tissues into human bodies and the artificial regeneration of human body parts. As one woman suggested: "*Maybe what we need to be looking at is, is that a potential solution*", rather than focusing on the breach of the sacred boundary between human and animal life forms.

Finally, we want to stress a final point about nature that has political implications. Participants also linked their perceptions of nature to the degree of information they were presented about the various biotechnologies.

There's something else behind it. So they might say they're doing pig cells but there could be more to it. So I think they only inform us so much. And so I think that's why it's very hard to decide on what's natural and unnatural when you're only given half the information. Like sitting here now it's very hard to make a decision on what's natural and unnatural when you're only given, you know, what's this [limited information].
Female, Waipukurau

Whilst this comment refers to the particular context of the discussion group, it can arguably be extrapolated into the wider political arena, alluded to in the first three lines. Namely, participants feel that they were deliberately shrouded in ignorance and unawareness, and hence were not able to make valid, rational decisions about particular biotechnologies, or their relative naturalness or unnaturalness.

In New Zealand, one more conception of nature that differentiates it from other locales lurks in the public imagination: the clean green image that the country prides itself on. In the next section we examine the role this image plays in determining how acceptable focus group participants found novel biotechnologies to be.

5.3 New Zealand's Clean Green Image

New Zealanders and visitors to New Zealand often remark that one of the main attributes of New Zealand is its clean green image. As Dew (1999:53) suggested: "The symbol of clean and green New Zealand provides a very strong cultural resonance which strengthens chains of cultural meaning and provides a strong impetus for action". When "this symbol is grounded in the nation's self-image and its economic dependency" (ibid.:53), it was not surprising, that during focus group discussions about biotechnology, "*clean green New Zealand*" frequently arose as an area of contentious debate. But what does this image mean to the public? What is its connection to biotechnology? And why is this important?

During the focus group with members of the Asian population, one man referred to the clean green image as an "*icon*" – symbolic of New Zealand culture and national identity. As an immigrant, he was critically aware of its emblematic nature. This was in contrast to the more subjective feelings that arose for many European New Zealanders when they thought about the future of New Zealand and environmental/agricultural biotechnologies. These emerged as positive comments such as these: "C*lean green image is the place I prefer to live in*"; "*I would like to see a clean, green New Zealand, which to me is essential for up and coming generations*"; "*We sell our meat because we have this nice, clean and green environment*" or "*I think we've got to make quite sure we always keep a clean green environment in New Zealand*".

The two terms, New Zealand and clean/green, were synonymous with one another. However, as one participant suggested, not everybody felt the same positive associations with the term or considered it part of their national identity. Rather, "*Its something that we value, but there are an enormous number of families that don't even appear to feel it's a concept worth valuing*".

The responses to clean green New Zealand were thus ambivalent, but almost always tinged with emotion sprung from an icon symbolic of national identity. Moreover, the term seemed to emerge during conversations as a response to a nature that was perceived to be under threat, whether from environmental destruction, environmental pollution or new biotechnologies. As one participant put it: "*The clean green. I'm totally against the raping*

of the coastline with all these shellfish and what's happening". But why was the clean green image so important to participants in their decisions about biotechnology? In order to determine its relevance, it is important to understand what people meant by the term.

Tourism brochures refer to PURE New Zealand, and this representation certainly reflects the general consensus on how participants perceive a clean green New Zealand.

> *Its just the quality of air, water…tourism, you see pictures of crystal clear water. I've travelled to a few cities where the air is diabolical you can see the smog hanging around.*
> *Female, Auckland*

> *I don't want us to lose this clean green image that on a whole we do have, that people always seem to comment on; that tourists to Dunedin especially say that we're so blessed with what we've got here. I don't want to lose that 'cos its too; all wonderful nature walks for heritage, having a beach 20 minutes away. I want that to be there for future generations. I want to always be happy living in New Zealand. I don't see another country I'd rather live in.*
> *Female, Dunedin*

In theory, as these comments imply, clean green is associated with an abundance of accessible natural environment - pure and unspoilt. In international tourism brochures, this image is predominantly visual and dominated by green hills, pastures and icy blue glacial waters; unsullied landscapes of the imagination. Moreover, this clean green image has a materiality to it, for New Zealand is perceived as a "*healthy*" place to live and a "*good place to bring up kids*".

Data from the focus groups thus suggests that the clean green image of New Zealand is a timeless construct that merges the historical purity of a traditional nature with the benevolent good of a wise nature. Like all photographic images, it is inherently static; a romantic image that is somewhat contradictory to technological progress.

However, whilst participants were aware of the importance of the clean green image for international tourism, the agricultural economy and their own sense of national pride and identity, most also recognised the circumspect nature of the icon. There were three dimensions to this circumspection: international comparison, the fact that it was only an icon and, somewhat derivatively, it was not really valid of contemporary New Zealand.

Firstly, the icon is comparative. Clean green New Zealand was defined by its direct contrast to overpopulated countries such as Europe and Asia, where architects, pressed for space have been resigned to building skywards. Polluted cities continue their cancerous spread into rural landscapes, churning up the ever-shrinking countryside.

> *Male 1: You see, we think we're losing our clean, green image. You know, you go visit somewhere like Hong Kong, Singapore, they'll always think we're clean and green because …*
> *Male 2: Because they haven't got any!*
> *Male 1: No, the fact they haven't got any space. They've had to build upwards and not outwards because there's no room.*
> *Notetaker: Its all a degree of comparison isn't it?*
> *Female 1: So they're always going to perceive us as being clean and green even if we don't think we are.*

Focus Group, Waipukurau

Male: Other countries do think NZ has this perfect clean green image but its not as perfect as everyone makes out.
Female: By comparison perhaps we are clean and green.
Focus Group, Auckland

Although comparatively speaking, New Zealand was clean and green, many participants felt that the country could not maintain this image and also submit to industrial and biotechnological progress. For many, the two were contradictory and could not co-exist, as apparent in statements such as: "*GE, don't want that, want to stay clean and green. It's two opposite ends of the spectrum*" or "*at the moment we've got so many people going through [Abel Tasman], it's almost ruining the place forever*".

This polarisation was most apparent when participants discussed the emotive topic of introducing synthetic toad genes into potatoes. Genetic engineering was perceived as a real threat to the image of clean green New Zealand.

Female: Some of these developments have side effects. We could destroy the very thing that we say NZ is great.
Male 1: The potato. That has the potential to really damage our green economy. The stem cell one could be a brilliant thing for New Zealand, because there's very little chance of it running rampant throughout by itself.
Male 2: That makes a big difference as well, whether or not something can get out into the wild.
Focus Group, Auckland

If we want natural clean green, it doesn't include potatoes that have been syringed with toad genes in the lab and multiplied. I don't know what they're doing, but that's what I think of.
Female, Dunedin

It was noticeable that the "*toad potato*" as one participant called it, featured highly in critiques of biotechnology as they related to this national icon.

Secondly, there was a strong realisation that the clean green icon was merely that. Namely, New Zealand was not as clean and green as the population liked to consider it to be: "*Keep its green image, but I don't think it's as green as people think it is. More organics, agriculture to go organic on a much bigger scale*".

Although recognising that comparatively speaking, on a global scale, New Zealand was clean and green, participants were also sorely aware that their clean green image faced similar threats to other nations: "*The country has a tendency to bask now and to say that it's clean and green and actually looking at the reality of what it's really like*". For instance, Auckland rapidly encroaches on neighbouring rural landscapes and Christchurch faces a dilemma with highly visible wintertime smog.

I was driving along the motorway the other day and it was trying to rain and you could see the grey on the vehicles in front of you. Quite frightening, what's actually happening.
Male, Auckland

These anxieties often emerged during the expression of a desire to stop this destructive progress and maintain a state of traditional nature.

I'd like it to stay the same. Well, the image that it has now, if not improve a little bit. Like, if they were to possibly keep the same it might not be the same, the way that they're continuing. But we should clean up our act a little further if we want to keep the clean image...obviously the technology to get advanced but no concrete. I don't want concrete. Keep the green, nice. Not to get too big, but just within ourselves get better.
Female, Dunedin

Finally, following this comment, the icon of clean green New Zealand was perceived as temporally polarised, for this national imaginary exists predominantly in either the past or the future. Albeit in marketing brochures, in the public imagination it did not *generally* appear to be an accurate iconographic representation of the present. Rather, it existed in the untainted space of traditional nature, temporally distant from the present. Alternatively, the clean green image was an ideal imaginary projected into the future from this distant past – an ideal that once was, and that we should be aiming for: "*I would like to see New Zealand go back to the green that it used to be and that everyone else has talked about*".

To a certain extent I think the clean green image is what we may remember from when we were younger. What we'd like New Zealand to be. It's a wish list for most. We have a way to go to become truly clean.
Female, Auckland

I think you've got to fight though. That Helen Clark - I see her as being a fighter for every bit - that image of the clean, green country. I think she's actually fighting for every little part of - keep that. So she's trying to keep that and make it real, still realistic and still happening.
Female, Waipukurau

These remarks suggest that the clean green image is perceived as temporally distant and acknowledged to be a utopian ideal that the Prime Minister and population can fight to achieve. Interestingly, a small group of participants saw biotechnological innovations in the 'environmental stream' as a means to re/construct this dream and make it a reality. In this scenario, biotechnology was a tool that could reproduce and remake New Zealand as an imagined Garden of Eden (see Merchant, 1989).

Consequently, when this image was under threat from environmental degradation, and national pride at stake, the clean green image and biotechnology could in theory be perceived to co-exist. As one Waipukurau farmer said when asked about the relevance of using biotechnological resources to help prevent greenhouse gas emissions from New Zealand sheep: "*We pride ourselves on being a clean and green country…then putting something forward that will cut that down, then why not*?" He later furthered this assertion, making reference to the importance of new biotechnologies to help buttress this image.

As I said before, we pride ourselves on being a clean green country and over the years we've put a lot of crap on our pasture, and that. So, if we can get rid of all the stuff that didn't do anything or 'cos talking to old guys over the years they say, "Oh, we just put on this stuff, and then a few years later chucked on something different". So there's still a lot of toxins and that in our grass and our soil, so if we can get rid of that and step back to square one, and find out what's good and what's not what's been trailed, then chuck whatever on, and the follow-on effects as well - so cleaner, greener grass and that. Have better healthier animals, which have better milk and better meat.
Male, Waipukurau

This farmer was not alone in his thoughts about the potential environmental benefits of using selective biotechnologies in New Zealand, particularly to boost the national clean green image.

Male: As long as its controlled I think it could enhance our clean green image.
Moderator: Why do you think it would do that?
Male: I just think, I mean, we go on about the 'clean green image', what we have to offer here in terms of environment and things. I just think it would enhance that, our animals, our cows and whatever. We can supply the best of that as well, as we can also supply the best of other things. Yeah, I think it would be good for us, help our image.
Focus Group, Dunedin

Rather than perceived as threatening, for some participants, biotechnology was viewed as a useful tool for New Zealanders. DNA testing of export meat to prove its New Zealand origins was thought to benefit New Zealand's clean green image. Using a GM virus to clean up DDE contamination was envisaged as a necessary measure to re-purify the soil and fitting sheep with methane-reducing devices was acknowledged to be one solution to reduce New Zealand's undesirable image as a Western World greenhouse gas emitter.

It could actually help our export because we can assure that our milk/meat has got nothing in it then other countries, apart from England may also want some of our meat as well.
Male, Dunedin (comment on DNA testing meat)

I think were all agreed on the clean/green side of it. How green we are is up to debate. I think where our future lies is working to our advantage, which is in the natural environment we do have. We don't need to perfect every technological and scientific advance but work in the areas where can actually gain the best advantage.
Male, Auckland

Overall, the impact of the clean green image of New Zealand on public attitudes to biotechnology is somewhat polarised, and is clearly dependent upon the way this icon is understood and valued by participants. Whilst a significant number of participants were adamant in their concern that genetic engineering would ruin this national image, others saw the potential for the development of an environmentally sustainable New Zealand, in league with the development of new biotechnological innovations that would allow the country to compete in an international marketplace.

I think we've got to think outside New Zealand. It's a world economy; you've got to survive, have money to trade and do things and that's why we talked about in the beginning clean and green and all the other bits and pieces. We're still trying to sell ourselves and to sell something you've got to have something to trade. You could produce everything you wanted and live in a cave that's what you'd do but you cant. So you rely on other people who have resources of one sort or another that you require, and you trade with what you have, and you develop it to the extent that you're the best at what you do. Therefore you can claim the premium. Male, Auckland

5.4 Spirituality

Whilst participants were extremely forthcoming about their perceptions of nature, the natural world and clean green New Zealand, there was some reluctance to discuss the relevance of spiritual values to perceptions of biotechnology. Comments were fleeting and subtle, and only on rare occasions did they develop into full-bodied conversations/arguments. In general, we assumed that only those familiar with spiritual concepts, who felt confident enough to voice them in this context, spoke out. Participants who did choose to speak out were either Maori (Maori values will be covered in a separate AERU report by Mere Roberts), Christians, or in response to Christians, self-declared atheists. We made this assumption because when the issue did arise, participants were encouraged to discuss spirituality (verbally and through stimuli such as cartoons), but we were usually met with what could be interpreted as an embarrassed silence.

But why was there a reluctance to discuss spirituality? Did it play so slight a role in decision-making? Was it disguised as attitudes to nature? Why were other religious groups so under-represented? Firstly, we suggest that the predominance of Christian and Maori voices is a consequence of New Zealand being a nation dominated by these two distinct yet overlapping belief systems. Perhaps a lack of other voices is the consequence of being an invisible minority within the nation? Would it be acceptable, for instance, if you were a Muslim or a Wiccan, to express your beliefs in the dominant cultural climate?

Secondly, we suspect that the overall reluctance to discuss spiritual values, is that participants considered them to be non-scientific. In a context where people seek to defend their arguments against particular kinds of biotechnological interventions, people are aware that religious beliefs are devalued as non-scientific, and hence, non-objective. In support of this theory was the reality that participants turned to popular science – scientific (and pseudo-scientific) facts - to refute what was perceived as often "*dangerous*" scientific experimentation. We saw this as an attempt to rationalize their arguments by using apparently valid evidence rather than an emotional response. In the context of the focus groups, the unforeseen consequence of this emphasis was that it was difficult to determine whether or not the use of these 'facts' was a real motivation, or an attempt to disguise the subjectivity associated with religious/spiritual beliefs and play the game of science by rules that participants didn't fully comprehend.

With this in mind, we now turn to the role of a predominantly Christian spirituality in assessing the place of biotechnology in society. Often prompted by a cartoon on cloning (see Appendix IV), where the scientist was depicted as trying to copy God, participants drew discussions into the topic of what God was. This is an important issue, because it acts as a reference point to determine what humans are, and in particular, where scientists stand in this perceived hierarchy of power.

For the participants who spoke, God was always gendered – an all-seeing male, with special powers, who like wise nature, was benevolent and "*good*", had strong ethical values, was all-healing, and had the ability to create life from nothing. God could also predict the future, for "*he*" had the "*full information*" on the creation of life on earth. Interestingly, we can say that God was often defined by his conscious actions - the co- acts of creation and destruction – and by his prescience: "*God does something knowing what's happening*".

This construction of God usually emerged in discussion via a direct comparison to scientists. Namely, there was an assumption that scientists were trying to play God or take on the characteristic role of God.

> *Yeah, you're playing God, you're changing our natural environment.*
> *Male, Waimate*

> *People now will be breeding embryos to put away because they get paid for them because some private hospital is short of them and it's going in like they do in the States now, they pay you to go and get a blood transfusion. Someone will be paying you to go and give them some of these. And this is what frightens me. I believe then we're now starting to try and play God.*
> *Male, Wellington*

The main crux of the argument seems to stem from the comparison made between the divine creation of life and the human creation of new life (through genetic engineering), or our power to destroy life (embryos used within stem cell research).

However, there were a number of issues that arose, and we find the most appropriate way of expressing them is by suggesting that the laws of the bible act as a means to decode the apparent chaos/complexity and uncertainty stemming from scientific advancements. These laws create boundaries from which to interpret the world, boundaries that were argued by some to detract from progress. We deal with each of these moral codes below and their impact on perceptions of biotechnology.

5.4.1 Humans are Made in the Image of God.

The notion that the human form mirrors the divine form, and was consciously produced with this intent in mind, is a common thread that knits together all the focus groups.

> *I weighed up the pros and cons for most of those except for the stem cells because I believe we are all made in the image of God and we shouldn't destroy it.*
> *Female, Wellington*

> *I think the whole thing here - this biotechnology - this is not just taking the same plant/family and modifying it slightly or something simple like that. This is going; this is blending animals with plants or humans with plants or humans with animals. This is really changing the face of the earth as we know it and the Bible actually says that God has made man in his own image and we have to consider that avenue to. Because if we don't we are not living under a democratic process. So you know that is a real thing for me. We are starting to really play with fire.*
> *Male, Waimate*

As these two comments imply, when this divine image and biotechnology intersect, a persistent perception is that as humans, we are perverting this image. As God's special creations, humans are trying not only to copy God, but to *become* God through the construction of new organisms and control of life itself.

> *Male 1: That guy trying to find God? I gather that's what he's trying to do anyway. He's doing it out of a test tube.*
> *Female: He's trying to copy God.*
> *Moderator: Do you think that is an issue?*
> *Female: Playing God?*
> *Male 2: I don't think it's trying to copy God that is the problem. It's trying to BE God. God does something knowing what's happening, we do it and its like for example, a little boy watches his Dad shaving; that looks fun, I can do that, grabs the razor, having a wee shave not knowing exactly what he's doing. Dad knows he has to put shaving foam on and knows you have to pull in a certain direction. It's not the inability to make the full decision, but just trying to copy God, trying to BE God by altering natural processes is what we do when were trying to do something we don't know about without seeing the fully encompassed information.*
> *Focus Group, Auckland (comments on cloning cartoon)*

> *We have a choice between non-GE and GE foods. Maybe these people who are scientists try to create or recreate something. They are trying to be God. And why should you be playing around with it.*
> *Male, Dunedin*

In participants' minds, when humans try to copy God, they make mistakes, because we are not all seeing and cannot predict the consequences of our actions. Thus, humans intrude into "*forbidden territory*"; the boundaries this God has created and into which we should morally be denied access.

However, scientific advancements have shown that humans do have physical and mental access to the "*stuff of life*".

> *I could believe in God and say well God put us on this earth, God created us and God gave us minds, and those minds are starting to play with genetic material. As his people claim him to be then playing with GE stuff is something he's brought for us to do.*
> *Male, Dunedin*

In this perspective, if God has designed humans with a curious and intelligent mind, and we are able to discover and begin to tamper with the stuff of life, then this was God's will and intent in the first place. Not surprisingly, this came from the same male who argued that as part of nature, we are morally correct to consciously evolve nature.

5.4.2 Stewardship

Humans, made in the image of God, have been granted special abilities and according to Genesis, given dominion over the earth. Whilst we have considered this concept of stewardship within the section on nature/s, it is apt at this point to filter this concept through the lens of Christianity.

God created everything on the earth but God created humans with a special ability but with that special ability came responsibilities that we had to look after things, recognise that position of power so that we can help that. Respecting what nature is - guardians of nature, stewardship of nature - we've also got the responsibility not to and that goes over that.
Male, Auckland

But then if we believe God created us, we're part of the natural order. We are responsible. God made us responsible. He didn't make dogs or the trees, he made us responsible to dominate but also to keep the planet and everything on it and I believe we shouldn't have crossover of animal genes with ours because everything reproduces after its own kind.
Female, Wellington

From this perspective, the role of humans is to be guardians of the planet, guardians and protectors of God's creation. We have been granted power over this domain and with that role comes responsibility and accountability. For people who adhere to stewardship, experimenting with genes, and manipulating God's creation is beyond our designated role. These acts become unnatural, for they go against human nature, as dictated by God.

5.4.3 God is the Great Creator

Following the image of what God is, an all-seeing, all-knowing, prescient God has created the earth out of no-thing. Because God is viewed to possess knowledge about everything, some participants implied that he has the gift of foresight and is aware of the future. For these people, nature was predictable, and God as the great manipulator had full control over the destiny and evolution of the planet.

For many, scientists were perceived as trying to displace this rule, and act as 'demi-gods', but without the knowledge and foresight of what they might create. This notion was particularly strong during the Waimate focus group, and led to a debate about the differences between the acts of creation and modification.

Male 1: Well we're not playing God. We're not creating things. All we're doing is modifying, as we've done from the moment we got our hands on our first animal we started modifying it. We started…
Male 2: Crossbreeding
Male 1: Training. Well sorry, domesticating it. Then we started crossing it with another one that was a bit better, or a different type that was a bit better.
Male 3: Well we're creating something new.
Male 1: No, we're not creating a damn thing. All we're doing is cross breeding.
Focus Group, Waimate

According to the first speaker (a self-defined atheist, who was aware of biblical references), the act of creation involves the production of something completely alien to the planet and its physical laws. Rather, humans have simply been modifying existing materials and processes, rather than constructing something unique and different (the creative act). They have been working within the boundaries of what is physically possible. As humans, we cannot create genes or life itself, but merely manipulate it; there is a distinct difference between the acts of creation and modification.

In contrast, the third speaker, a Christian, argued that when we manipulate genes, we do create something new; a new life form. Therefore, the production of something novel was perceived as an act of creation. Clearly, the basis of these arguments was semantic and rested upon the definition of the creative act, and our right as humans to partake in this. Does biotechnology create something new, or does it merely changing the materials that already exist? Is it morally right to steal this creative power from God?

The discussion also revolved around the right to create something new without the information to predict its consequences. As humans, is it morally wrong to create without full awareness and knowledge?

> *Male 1: Just because we don't understand something doesn't mean it's wrong or bad…I think that we're going into something as individuals that we don't necessarily understand and therefore feel uncomfortable about it. But that doesn't make it wrong in my mind.*
> *Male 2: But you could be going down the same track as 20 or 30 years ago they went down with DDT. That's the scary bit.*
> *Male 3: Of course you could, but then you can't stop progress*
> *Focus Group, Waimate*

In this discussion, the first speaker argues that ignorance should not be equated with evil, and that pushing at the boundaries of the unknown should not be perceived as a malevolent act. Rather, as the third speaker suggests, this is necessary for progress. In contrast, the second speaker, a Christian, defends this argument by pointing out the unpredictable consequences of human actions and, in direct contrast to God, a lack of human prescience. When humans try to take on the role of God, they blunder.

The consequences are perhaps reflected by the words of other focus group participants, whose discourse draws upon one popular science fiction on GE: Frankenstein's monster.

> *Female: And to me, being a Christian, it's not biblical. You don't do that. That's God's department.*
> *Male: But they're trying to do it.*
> *Female: They will try.*
> *Male: They've done it.*
> *Female: They want to be smarter than him [God].*
> *Male: Another Frankenstein. What's been done.*
> *Focus Group, Waimate*

> *Male 1: I think it's the idea that Frankenstein was a man-made man and saying you can't play God because look at what you create. It's a synthetic [muffled] all scientists and monsters.*
> *Male 2: Those monsters may be fantastic food.*
> *Male 1: But you eat with your eyes, so I wouldn't eat that. Doesn't look good.*
> *Focus Group, Dunedin*

The theme of unforeseen consequences was woven through all the focus groups and emerged as the hidden agenda of the next 'rule'.

5.4.4 The Sins of the Forefathers will Visit the Third and Fourth Generations

The biblical heading of this section derived from a reference to genetic engineering – in particular, the insertion of a synthetic toad gene into a potato.

> *Male 1: A copy. But it's not the immediate effect it says, the bible also says, the sins of the forefathers will visit the third and fourth generations, and it happens in [muffled] and it could be the same thing that happens with what we're doing with these genes.*
> *Male 2: You can't get a result seriously though can you?*
> *(Talking over each other)*
> *Male 1: Yes, you can.*
> *Male 2: Well what about an eye for an eye?*
> *Male 1: There's evidence.*
> *Focus Group, Waimate*

Although this discussion was somewhat obscure, and seemed to contain esoteric references, understood only by community members, it reinforced the perception that genetically manipulating nature, will have unforeseen consequences. There was a popular fear that when humans try to imitate or be God, they will create monstrosities; by meddling with unnatural processes, they will create a new breed of mutants that are alive and can reproduce. These side effects may not impact upon the generations that created them, but upon their children and children's children.

At its most extreme, one Wellington woman believed that as humans, we were eternally doomed, due to this concept of "*original sin*". Among the groups, this perception was something of an anomaly. Nevertheless it deserves to be noted, because it guided every decision that this woman made with regards to the acceptability of biotechnology.

> *Female: Do you want to know why? This is what I know. Because sin is in the world. The world is designed to keep [unintelligible] and nothing we do will make it better. We can try.*
> *Moderator: But you think it's not possible at all?*
> *Female: No, it's not possible.*
> *Focus Group, Wellington*

In biblical terms, Original Sin was the sin that Adam committed by eating an apple from the tree of knowledge – the sin that we all have to pay for, as Adam's descendents. According to this one woman, there was no solution to this predicament – everything we do is wrong, and our descendents will always pay the price for our mistakes. In her view, there were no distinguishing moral or ethical differences between any biotechnological innovations – they are all sin.

Whilst these rules act as guidelines for human behaviour, it is clear from some of the debates within consecutive focus groups that they can be interpreted in many different ways. Such moral codes can be manipulated to either challenge the science of biotechnology, or support it. However, other participants directly challenged these codes as out-dated and rigid: "*Some of us atheists are a little but against the country being run on what the bible says"*. In this view, the rules dictated by the bible constructed boundaries that limit human creativity and thwart progress.

Nevertheless, for some participants, the rules and values attached to their spiritual beliefs directly impacted upon their attitudes to biotechnology. In fact, the focus groups demonstrated that that spiritual belief could override the rationality associated with scientifically trained minds. The following two excerpts are from women trained and working as biologists, who during their respective focus groups provided consistently rational arguments that were quite supportive of scientific advancements. However, both had limits.

> *The Indian mythology says that even if the baby is not born, when it is developing in your body, it can understand and it can hear you. So – it's like exploiting a life, which has not even seen the world.*
> *Asian female, scientist, Auckland (comment on embryonic stem cell research)*

> *If you don't have limits to how far you can go, you run the risk of scientists becoming demigods in terms of controlling future generations. I mean that's a very; that is a very farfetched sort of concept but I mean, if you go into … oh it's fine, it's natural, it will happen. Well no, it's not natural. Pigs' hearts are not supposed to be transplanted into humans. But I know your body will naturally reject them. I mean they are so drugged but I mean you can't just pop one in and it will function fine. It's not natural.*
> *Female scientist, Dunedin*

For both women, these limits revolved around spiritual issues, whether seeing scientists as demi-gods or the creation of life. Whilst support for this argument was limited in this study, further research would be beneficial to explore the relationship between science and religion, scientific rationality and spiritual values.

Although this exploration of the impact of spirituality on decision-making focused predominantly on Christian morals, we suggest that spiritual values are more deep-rooted and culturally engrained than scientific rationality. They are embedded in everyday life and practices. Moreover, spiritual views provide people with moral anchors from which to determine appropriate ethical behaviours; ethics that filter into debates on regulatory controls over biotechnology research.

5.5 Summary

We argued in this chapter that the acceptance/rejection of new biotechnologies is highly dependent on the way we perceive nature, the way we understand our place in nature, and how these impact upon the way people draw the boundaries between what is natural and unnatural. Whilst there are many competing and complimentary versions of nature, a fairly consistent view was that natural spoke of things that are unmodified, unchanged. That natural predates sprays and chemicals, hence existing in a space-time of the traditional. Yet, whilst nature is increasingly seen as a dynamic, complex ecosystem, this perspective somehow conflicts with the idea of traditional nature.

This exploration of nature/s and its relevance to biotechnology in the focus groups raised the question of boundaries, as we became aware that:

- The boundaries participants drew between what was natural and unnatural were not necessarily in the same place as their peers.

- These boundaries were far from absolute and were dependent on differing conceptions of just what nature was.
- Nature was a multifaceted construction, with overlapping meanings that were used in different contexts.

Whilst we have argued that nature/natural/unnatural are reference points in why the public reject or accept novel biotechnologies, the issues are far more complex than this, as some of the quotations we have selected have illustrated. Although competing versions of nature jostle for position, they are consistently used to downplay new biotechnologies, with some exceptions.

New Zealand's clean green image featured in discussions about agricultural and environmental biotechnologies. In the public imagination, this icon was not a symbol of the present, but existed in the past and future as an ideal Utopia. The clean green representation of a pure New Zealand embodied national identity, and was cited to both support and refute new innovations. Its status was thus ambivalent in the public imagination. Could New Zealand use genetic modification to clean up its act? Or would it likely further damage the landscape and economy with the ever-present threat of unforeseen consequences?

When it came to more spiritual matters, New Zealanders were generally reluctant to reveal their belief systems and engage in discussions about their relevance to perceptions of biotechnology. Participants that did, were predominantly Christian and felt strongly about their religious beliefs. Discussions showed a series of moral codes that underlay participants' responses to novel biotechnologies such as GM, cloning and xenotransplantation. These included references to Original Sin, stewardship and playing god.

When nature, clean green image and spirituality are considered alone, they constitute simple rules for decision-making, based on what is acceptable and not acceptable. These rules may of course shift over space and time according to a change in worldviews, attitudes and values. However, when we consider all relevant factors governing our attitudes and values – personal choice, personal experience, safety, economics – the equation becomes far more complex and uncertain.

When all these factors play off against one another, we are left with a complex situation, one in which each stage of the decision making process is fed back into the equation. The outcome of this decision making is likely to become increasingly unpredictable and messy, the more factors are fed into it – and this includes participation groups such as this, in which participants come to realise the arbitrary nature of boundaries, constructions of nature and that their standpoint about biotechnology is just one of many.

Chapter 6
Discussion and Conclusion

6.1 Introduction

This study aimed to examine public perceptions of the impacts and risks of biotechnology in New Zealand. More specifically, it was designed to determine the relative importance of these risks and ascertain the underlying attitudes and values that underpinned these risk perceptions. These objectives and the use of focus groups were compatible with the results from recent qualitative research on public perceptions of risk.

The results presented in this report focus on attitudes and values that colour perceptions of new biotechnologies and their associated risks. In particular, our focus was on the role conceptions of nature, New Zealand's clean green image and spirituality play in determining the acceptability of particular products and processes. Moreover, we located these influential factors in the meanings that biotechnology had for participants and its relative importance in everyday life.

In this final chapter, we re-iterate the key findings of the two previous chapters. This provides a basis for the integration and theoretical discussion of these results. Their implications are outlined in terms of methods, theory and policy.

6.2 Overall Summary of Results

The key conclusions from previous chapters have been divided into relevant sections below. These sections discuss the relative importance of biotechnology to New Zealanders, the public understanding of the term, the role of nature constructions in determining the acceptability of particular products, the relevance of clean green New Zealand and role of moral codes in public attitudes towards biotechnology. Finally, we discuss these key conclusions in relationship to the European PABE report.

6.2.1 How Important is Biotechnology to New Zealanders?

As a term, 'biotechnology' does not have a noticeable presence in the public arena and was not part of 'everyday talk'.[1] This may be partly due to its lack of discursive integration into everyday life, and sporadic bursts of media coverage that are quickly forgotten. Indeed, the majority of references to biotechnology as a public concern were to genetic engineering, with which it was frequently equated during discussions. Rather, biotechnology was superseded by more immediate concerns about primary health care, education, employment, housing and the state of the New Zealand economy.

When biotechnology did feature in discussions, it was related to environmental concerns, public scandals and genetically modified foods. It did also emerge as a factor when linked to economic development. However, New Zealanders generally favoured the expansion and diversification of agriculture through a variety of means that included organics, specialisation, value-added products and possibly biotechnology. When they considered New Zealand's geographical isolation, size and stage of economic development, members of the Asian population (typically, recent migrants) were also favourable towards the growth of hi-

[1] We appreciate that GE and GMO have, in recent times, been popular media topics, and hence these more specific terms have diffused into public discourse.

tech as a compatible industry to agriculture, but one that had the potential for high profit margins.

6.2.2 What do the Public Understand by Biotechnology?

Common institutional discourses define biotechnology as the use of living organisms to make products and solve problems. Although biotechnology has been around for a number of years, few participants identified its roots in bread making and brewing. Instead, genetic engineering emerged as the dominant understanding of what biotechnology was. However, participants were fairly knowledgeable about recent events such as 'Corngate', the xenotransplantation of porcine pancreatic cells into diabetics, Dolly the cloned sheep, and the imminent lift of the New Zealand moratorium on genetic engineering. They were not aware of more inconspicuous uses of biotechnology such as manipulating bacterium or medical cloning. Based on the prevalence of imaginary extreme events, it was not surprising that biotechnology was also associated with environmental pollution/degradation, in both accurate interpretations of its meaning and in misunderstandings.

Biotechnology conjured up popular images of Frankenscience: scientific experiments that took place behind closed doors. In many participants' views, there was a conspiracy of secrecy, as lack of physical access to research sites and unbiased information bred mistrust. This led to associations between biotechnology and what was termed 'secret science', dominated by humorous images of men in white coats conducing laboratory experiments on the cells of living organisms. These mysterious laboratory creations were imagined as artificial rather than natural. In this shroud of secrecy, the dangers of science were perceived as being invisible to the public eye (see Beck, 1992).

Finally, biotechnology was also associated with change, whether it was interference (a negative connotation) or progress (more positive). There was an overall feeling, which stemmed from a broader context, that change could be too rapid. Moreover, the question was asked – who benefits from this progress? Social and economic benefits were acknowledged, but participants realised that this was historically at the cost of the environment.

6.2.3 The Intersection of Biotechnology and Nature

Nature is one of the most complex words in the English language. It is a multifaceted term, historically and geographically rooted in a number of epochs. In this study, nature was one of the key themes that influenced focus group participants in their decision-making over the acceptability of novel biotechnologies. This usually manifested as references to the relative naturalness-unnaturalness of the exemplars that participants discussed. However, rather than a "natural is good, unnatural is bad" division, the use of nature in decision-making was far more complex and ambivalent.

Dominant perceptions of nature were:

Wise nature – a healer that is intrinsically good and a moral framework from which to interpret human interference. If biotechnology pushed outside of the boundaries of what was dictated by wise nature, it was deemed unnatural.

Traditional nature – pre-existed before the birth of participants or during childhood, and was a nature of time-past that could be re-established by refusal to accept genetic engineering. This nature was pure and unsullied by human interference. Biotechnology was

seen to pervert this purity. Yet whilst participants were reluctant to change traditional nature, they also simultaneously wanted progress.

Animated nature – nature is a process, dynamic, shifting and evolving. Harnessing animated nature and the aliveness of biological organisms was perceived as dangerous due to the possibility of unpredictable consequences. What might these organisms evolve into?

Balanced nature – defined by ecological harmony; there were checks and balances when living organisms in the planetary system deviated from their place in nature. If genetically modified organisms were introduced into this system they might either run out of control, or be out-competed. This was because they did not co-evolve in a competitive environment, but were developed in the lab. Biotechnology was defined as unnatural as it brought in alien species to this environment, or it involved the displacement of something natural into an unsuitable environment (for instance, pig cells into human bodies).

Human nature – humans hold a special position in nature that amounts to stewardship of the planet. This special position makes us accountable for our conscious actions towards the planet. However, humans live in competition with nature, rather than working together in a symbiotic relationship. Whilst humans have the power to destroy the world, nature also has the power to destroy us, if we push it too far. Another stance was that we are natural. Taken to an extreme, humans are the conscious evolutionary force of the planet and biotechnology is natural because we are natural.

A final issue was the boundaries of nature: what defines us as distinctive from other animals and plants? And why are xenotransplantation, genetic engineering and cloning so abhorrent? Most participants found interspecies biotechnologies creepy at a very base, emotional level that could not be rationally explained. We suggested that underlying this was a threat to human identity. The body is increasingly being perceived as a part of self-identity rather than a machine, which can be repaired with spare parts. However, participants acknowledged that if personal need arose, they might be swayed away from their revulsion.

6.2.4 Can Clean Green New Zealand and Biotechnology co-exist?

New Zealanders felt quite strongly about their clean green image, whether they saw it as representative of national identity or a marketing construct. Associated with PURE New Zealand, and images of untainted, traditional nature, this icon permeated discussions on environmental and agricultural biotechnologies. In the public imagination, clean green New Zealand was not so much a part of everyday life, as a temporally distant Utopia. It was perceived as either traditional nature, lurking in the memories of childhood or a projection of how the future New Zealand should look. Moreover, some participants saw the clean green image as comparative; in contrast to Asia and Europe, where population pressure forced the cancerous march of urban sprawl into areas of aesthetic beauty, New Zealand still looked pure and unsullied.

Whilst there was certainly a sense of national pride in New Zealand's clean green image, ambivalence dominated when it was juxtaposed to novel biotechnologies. Some participants without doubt saw genetic engineering as extremely damaging to the environment and international tourist and agricultural export image. Unforseen consequences dominated these discourses, with much reference to the impact of DDT contamination on New Zealand agriculture. Rather, many people favoured the expansion of organic agriculture as a means to enhance this clean green image. However, a small minority of participants saw biotechnologies such as genetically modified viruses and insect-resistant crops as a means of

environmental remediation that, if safe, could re-establish clean green New Zealand for the benefit of all. As Jones states,

> With the recognition that chemically based agricultural inputs created widespread environmental pollution and degraded farmland, biotechnology proposes a 'cleaner', 'greener', and more 'natural' way to manage agricultural resources…agricultural biotechnology proposes to make an inadequate nature better (Jones, 2000:10).

Thus, there was some support for the improvement of nature through a biotechnology-induced evolution.

6.2.5 Subterranean Spiritualities: The Role of Moral Codes in Biotechnology Perception

New Zealanders were extremely reluctant to talk directly about spiritual matters, at least in the focus group situation. Rather, they emerged more as a feeling of abhorrence towards inter-species gene/tissue transfers and a reverence for nature, with references to stewardship and human accountability for planetary health. This suggests that these matters might be better discussed in the private space of one-on-one situations, with specific prompts that directly and subtly engage participants with the topic of spirituality.

Nevertheless, key advocates for Christianity dominated discussions that touched on spiritual issues and their intersection with biotechnologies such as genetic engineering and embryonic stem cell research. A series of moral codes based on biblical rules dominated their attitudes towards particular exemplars. The concept of Original Sin propagated a belief that humans would pay for meddling with nature. Moreover, humans were seen as playing around with the creation of new life, which was seen as God's territory. As mortals, we did not have the prescience to be able to predict the consequences of our actions and interference. Moreover, as stewards of the planet, we have accountability towards looking after every living thing in an ethical manner. This did not include manipulating genes.

6.3 Discussion of Results

In this report we dealt with biotechnology, nature, New Zealand's clean green image and spirituality as separate entities. However, as we have hinted during earlier discussions, there are considerable and meaningful overlaps between them. It was not sheer coincidence that they were juxtaposed in this report. In this brief discussion of the key results, we firstly draw together these connections.

We concentrate upon two aspects of these results that deserve further theoretical explication. Our first focus is the intersection of New Zealand's clean green image, spirituality, nature and biotechnology. How do they connect, and what ethical implication does this have? Secondly, drawing on recent work within human geography and environmental ethics, we introduce the concept of hybridity to the discussion and ask the question, what form would a hybrid ethics take in a posthuman/postnatural world where the material and ontological boundaries between human and non-human nature have been irrevocably breached? Biotechnology is already here – how do we approach it in an ethical manner?

6.3.1 Re-packing Spirituality, Nature and Clean Green New Zealand

> As Haraway notes, what counts as nature always has multiple dimensions – mythic, textual, technical, political, organic, and economic – which "collapse into each other in a knot of extraordinary density" (Haraway, 1994:63). Such knots are difficult to untangle (Castree and Braun, 1998:26).

Nature can be a physical/material reality that we engage with in a tactile encounter, but one that has been socially constructed through various experiences that occur over time and space. As we argued in the previous chapter, this makes it a manifold concept, with each nature construction overlapping with the next in a charged, interactive relationship. Moreover, this study suggests that how we construct these natures impacts indirectly and directly on our attitudes towards novel biotechnologies. Because these natures are embedded in historical contexts, they are also intertwined with other cultural, social, political and economic factors that they have grown alongside them. Spirituality and New Zealand's clean green image also grew amidst such contexts and historically have a deep, yet intangible bond with our conceptions of nature. Thus, we argue that these three constructs are inextricably linked to one another in the perception of novel biotechnologies. But how are they linked, and what implications does this have for the way biotechnology is viewed in New Zealand?

Firstly, we suggest that the foundation of New Zealand's clean green image is based on conceptions of a "*traditional nature*" and "*wise nature*". Rooted in childhood memories of how their country used to be, participants thought of nature as untainted, unpolluted, healthy and safe. Namely, they indirectly referred to the 100% PURE marketing image of New Zealand, one that is recognised as a temporally distant utopia. This nature past, of slow time, was directly linked to "*wise nature*", which acted as a healer, teacher and guardian of moral values. Human attempts to modify or improve on this nature were thus conceived as "*tinkering*" with a predetermined, God-given natural order.

Secondly, we propose that underlying the construct of "*wise nature*" is a complex history of Judeo-Christian values that still have an influential pull on perceptions of biotechnology. According to Wenz (1996), a Christian heritage is strongly embedded in Western conceptions of nature. This has particular resonance for New Zealand, with its strong Anglican and Presbytarian roots, and colloquial nickname of "God's Own Country". This Judeo-Christian heritage includes the concept of Original Sin, stewardship and nature (the world) as a moral good. When faced with novel biotechnologies, these moral values manifested as an ethics of stewardship, the concept of original sin, and a concern with God's role as the creator of nature. Sometimes, they were directly related to Christianity, in other instances, they were masked as feelings towards nature, such as connectedness and epiphany. In some respects, we suggest that nature has now become a substitute for formal religion in a secular world. However, "*wise nature*" has been recently interrogated by the question "is nature ever evil?", and in the shadows shed by developments such as genetic engineering, nature has been deemed ambivalent to humanity (Drees, 2003). Nature creates for its own sake, rather than specifically for human beings.

Thirdly, based on nature's ambivalence to humanity, we argue that the New Zealand public is starting to view nature as a complex, dynamic ecosystem in which human subjects are entangled. Rather than perceiving nature as a machine, it is a dynamic actor in its own evolution; a creative process. This has interesting implications when juxtaposed to new developments in biotechnology, implications that are highlighted by Hedley Brooke.

> Sensitivity to the knock-on (and possibly deleterious) effects of technological change is likely to be greater when Nature is envisaged as an organism or an interconnected web of interlocking processes than when interpreted in atomistic terms (Hedley Brooke, 2003:151).

Thus, one explanation for the potentially alarmist response of some participants, to genetic engineering was their underlying understanding of a nature that is a process, evolving through feedback, and which, if pushed beyond its limits could be tipped into systemic chaos. In this case, the lay public have become pseudo-scientists, using popular science to refute expert knowledge claims.

Finally, we ascertain that the divergence of competing perspectives on nature is symptomatic of a shift in our understandings of it, one that has been kindled in part by new scientific developments and comprehension about the world. This has more recently been fuelled by progress in genetic engineering, xenotransplantation and cloning that muddy the material and ontological boundaries between human and non-human nature. As Sutton (1999) argues, nature has also shifted from a physical entity that merely surrounds humans, to one in which humans are corporeally integrated. Such a shift has implications for both how we conceive human nature, our role in nature and our perception of biotechnologies (ibid.; Hedley Brooke, 2003:151).

Novel biotechnologies disrupt the naturalised separation between self and non-human other, between human, animal and plant. Notably, these identity disturbances forced participants in this study to re-examine their constructions of nature and how they used them to make value judgements about biotechnology. The material integration of human and non-human DNA and tissues, and the use of animals to remedy our own mistakes also raised questions of animal welfare. Why do sheep have to pay for global warming, by having their "natural" bodily processes disturbed? What happens to the animals whose cells are used for xenotransplantation into humans? Such questions marked the origins of an ethical stance towards biotechnology. But what form might this take? Questioning the place of humanity in a brave new world of trans-species led participants into an ethical dilemma of how to position ourselves in what has been described as a posthuman/postnatural world. In the next section, we briefly explore the impact that biotechnology has had on conceptions of the natural world, and some attempts at devising an ethics that might help us to negotiate it.

6.3.2 Moral Geographies: A Dialogical Hybrid Ethics

> *Male: But only humans modify nature?*
> *Female: Well, we're only aware of ourselves. We're not aware of what animals might be doing to change things.*
> *Focus Group, Dunedin*

Biotechnology and its various artefacts are beginning to remake both society and nature (Castree and Braun, 1998:29). As a result, we have entered what theorists have called a posthuman and postnatural world, where the boundaries between human and non-human nature, between humans and technology have already been eroded. Some researchers have started to focus upon the ethical implications of such a future. But what do these terms posthuman and postnatural mean? And what attempts have researchers made to grapple with the ethical issues that arise from these futures? This discussion section will conclude by highlighting some recent work within cultural/environmental geography that offers a framework from which to better understand the implications of research on biotechnology.

As participants in this study acknowledge, biotechnology is already here; we now have to address the emergent ethical issues that result from this awareness.

Posthuman is a term that conjures up futuristic images of cyborgs and to some extent it refers to the hybridisation of the human and technological (Fukuyama, 2002; Hayles, 1999). However, the crux of the matter is that this hybridisation, the merging of animal and human DNA and cells, the use of nanotechnology in human bodies, and indeed, the Human Genome Project, that revealed our genetic similarity to all lifeforms (see Waldby, 2000), have led to the destabilisation of the humanist project that saw the self as an autonomous, individual subject. The 'specialness' of humans that participants referred to in this study has been seriously dislodged, and replaced by an ontology that posits humans as relational. In the posthuman view, the 'natural self' is disbanded in favour of a subject that is "an amalgam, a collection of heterogeneous components, a material-informational entity whose boundaries undergo continuous construction and reconstruction" (Hayles, 1999:3). In this sense, Hayles argues that as subjects whose self-will cannot be clearly distinguished from other-will, we already are posthuman (ibid.:4). Rather than seeing the posthuman as an apocalyptic condition, she sees it as the potential to recognise and celebrate "finitude as a condition of human being" and understand human life as "embedded in a material world of great complexity, one on which we depend for our continued survival" (ibid.:5).

Moreover, as Hayles argues, this stance has ethical implications for our interactions with what has been called a postnatural world. This is a world in the nature-society dialectic been shaken by a posthuman inter-subjectivity, revealing that this dualism was always a false reality. In a human-centred world, the ethical implication is that as autonomous human beings, our responsibility is to maintain control; in a posthuman world, "conscious agency has never been 'in control'" (ibid.:288). Rather, a posthuman reworking of history, present and future can be one characterised by emergence, reflexive epistemology, decentralised cognition, embodiment, and a dynamic partnership between human and non-human nature, be it intelligent machines, transgenic species or other members of the biota (ibid.:288).

This emphasis on relationships and partnership provides a basis for an ethical approach to the postnatural, artefactual environment in which we, as humans, are intertwined. Recently, the term 'relational ethics' has become something of a catchword in discourses in cultural geography and environmental ethics. But how do we interpret such a term? And why is it an appropriate ethical response to a posthuman/postnatural world in the wake of a biotechnological revolution? To address these pressing questions, we briefly draw upon the interconnected work of Val Plumwood, Sarah Whatmore and Paul Cloke, and some of the key points they make in constructing such a standpoint.

Within the discipline of geography, Sarah Whatmore's project has been to explore hybridity, and theorise about an ethical stance towards hybrid worlds. These worlds are composed of the "living fabrics" of social life, rather than abstract spaces. Namely, Whatmore focuses upon the "relational configurations spun between the capacities and effects of organic beings, technological devices and discursive codes within which people are differently and plurally articulated" (Whatmore, 2000:266). Following the posthuman ontology, her project admits other players to the complex network of social life and follows a construction of nature as "am active, changeable presence that is always already in our midst" (ibid.:267). Whatmore critiques the instrumental use of "sensuous, social and creative" animals who are reduced to "gutless units" in the arena of biotechnology.

Instead, she emphasises the "humdrum" spaces of everyday living as the basis for an ethics that incorporates and animates animals, transgenic species and humans. The autonomous

human subject is removed from the locus of ethical subjectivity and replaced by an alternate cartography of embodied living in a "more than human world", "being-in-relation with and through heterogeneous others" (Whatmore, 2002:159). Although Whatmore does not provide detailed specifications of the form this new ethics should take, she thinks it should express "the creative impulse of more than human energies" (ibid.:165). Firstly, ethics should diffuse beyond the unified human subject. How do we renegotiate the 'we' of an ethical community in terms of its diverse composition, in which we are all corporeally dependent on one another? Secondly, ethics should be complexified by the introduction of hybrids whose energies should be recognised in terms of their promise, rather than apocalyptic potential ("the promise of monsters"). Finally, hybridity disturbs illusions of the bounded self and various imagined communities and beckons in new languages of attachment (ibid.:166-167).

Although Whatmore outlines the basis of a hybrid relational ethics, it is Val Plumwood, who we turn to for a more substantive account of how this might materialise. Coming from a background in environmental ethics, her stance is initially less positive than that of Whatmore. However, it is one that seems pertinent to biotechnology, which she sees as tightening the reigns on our control of nature. Plumwood believes that our current ecological crisis stems from the interactions between inadequate knowledge (ignorance), poor political structures (interest) and badly adapted, human-centred ethical, spiritual or philosophical worldviews (illusion) (Plumwood, 2003:237). Our separation from the natural world results in the loss of our ability to respond to it in ethical and human terms. Her answer to this is to reduce this separation from non-human nature and develop a "communicative, place-sensitive culture which can situate humans ecologically and non-humans ethically" (ibid.: 239).

In this brief consideration of ethics, space does not allow for a thorough account of Plumwood's philosophy. Rather, we outline the main rudiments of her argument in point form, below.

- On the ethical front, break down the human-nature dualism, rather than expanding animals into the privileged status that being human allows. This distinction should be less central to our ethical thinking (ibid.:168-169). An inter-relational ethics should attempt to reconstruct human identity in ways that acknowledge our animal nature and change our ways of thinking about rationality.

- Instead of seeing non-human nature as mindless, intentionless objects in a clockwork universe, recognise "earth others" as having agency and subjectivity. An awareness that non-human nature has intentional projects of its own and non-human agents are communicative beings (although not through human language) is known as the "intentional recognition" stance (ibid.:175). This allows us to reanimate nature as an active agent in our joint pursuits, and moreover, see it as a communicative other (ibid.:177).

- A narrative ethics, that supplies both context and establishes the identity of non-human nature can be used as a means to rethink its basis as a "realm of others who are independent centres of value and need that demand from us ethical relationships and responses" (ibid.:188).

- An attempt should be made to foster communication between humans and other species in their own terms, or common terms, rather than in an anthropocentric manner. This dialogical approach to ethics emphasises that non-human nature is always encountered as a potentially communicative other, and hence granted subjectivity (ibid.:190-193).

- Any ethical stance, should be infused with a sense of spirituality. This is not in the traditional sense, in which is it equated with religion, but as "a certain kind of communicative capacity that recognises the elements that support our lives" (ibid.:220). Namely, spirituality is to rediscover the 'spirit' in the clockwork universe. This spirituality should be materially and spatially grounded, in what Plumwood calls a "spiritual materialism", which emphasises the corporeality in the world of both human and non-human nature.

Thus, according to Plumwood, when we see the world through a spiritual lens and acknowledge it as an active agent, "meaning can be present also in the intricate contingency of the world", serving to re-enchant nature and open us out to chaos, novelty and wonder in the world (ibid.:227).

Moreover, drawing on the work of David Smith, geographer Paul Cloke (2002:594) argues that spirituality offers us anchor points in a sea of agnostic relativity, restoring some sense of moral certitude to the world. Ethical living in the world should recognise what Cloke calls "ordinary evil", namely, the passive acts of violence that we commit in our everyday lives. This amounts to taking responsibility for our actions, being mindful of the outcome of our actions and to feel the suffering of others in order to understand them. When biotechnologies are developed in the veiled secrecy of the laboratory, it is difficult for people to identify with any suffering that goes unseen. How can we identify with the suffering of the hybrid, oncomouse, whose cancerous fate is already pre-programmed into its very corporeality? Perhaps the growing awareness of the fusion of human and animal DNA, whilst precipitating feelings of abhorrence, also leads to a closer identification with non-human nature. If a part of me, is in the other, the weakening of the autonomous human subject may result in a stronger feeling for the other, and their respective suffering. Most recently, this was highlighted by a controversial New Zealand poster that depicts a GM woman with suction cups attached to her four breasts: a human milk machine (see Appendix 5). This was Mothers Against Genetic Engineering in Food and the Environment (MadGE) alternate vision of a posthuman future.

Although Cloke's paper was loosely focused on homelessness, these un-named others extend out into non-human nature in his later work (Jones and Cloke, 2002). What is missing from most accounts of inter-relational ethics is the creative agency of plants/trees in the term, 'non-human nature'. This agency, Jones and Cloke argue, is purposive rather than intentional, and "may become creative or transformative in particular circumstances" (ibid.:60). However, relational ethics for human-animal relationships cannot just be extrapolated onto human-tree relations. Although trees are embodied, they live, reproduce and die in different ways that need to be taken into consideration when assessing ethical practices (ibid.:112). This points towards a more contextual ethics in which place and time play a more significant role.

But what do these accounts mean for an ethical stance to the hybrid geographies created by biotechnology? Rather than answering this question in a definitive way, we allude to the idea of ethics as an ongoing process that adjusts to a changing world. Rather than providing answers, we suggest that Whatmore, Plumwood and Cloke point to questions that might be asked when addressing the impact of new biotechnologies on nature, spirituality and New Zealand's clean green image. What rights do plants have to refuse genetic modification? How do plants and animals communicate their discomfort when they are manipulated for the sake of science? How does a genetically modified tree suffer? How can we as humans, learn to pay attention to this? How can we respect the rights of non-human nature to continue as creative life forms, capable of reproduction and transformation? Is the use of non-human

nature to produce "monsters" that would never evolve naturally an example of "ordinary evil" disguised as scientific progress? How can we banish these monsters and re-enchant a posthuman/postnatural world? How do we integrate novel life forms into this world?

6.4 Implications for Policy

Although this report covers early data in the first stage of a New Zealand-wide study on public perceptions of biotechnology, our results do offer some guidelines for policy-makers. These guidelines parallel those of the European PABE Report, but are outlined in a New Zealand specific context.

6.4.1 When Faced With Uncertainty, Institutions Should Be Openly Communicative

To the public, biotechnology has an air of secrecy about it that breeds mistrust. Participants in this study were aware that new innovations carried risks, and were prepared during discussions to weigh them up against personal benefits. They were also aware of patenting regulations that necessitated the need for non-disclosure of scientific particulars. However, in order for scientific and government institutions to be trusted, as the PABE report concluded, the research process should be rendered more transparent. One way to achieve this is, as suggested by participants, is to establish biotechnology educational sites, which members of the public and schoolchildren could visit. Here, people could be introduced to "science in action" - a hands-on experience of new biotechnologies that would serve to demystify the processes that people fear. Such Science Parks have already been established in the UK and serve to educate the public on the benefits of the particular innovations for individuals and society.

6.4.2 A Need for Behavioural Consistency From Key Institutions

Participants in this study based their concerns about new products on previous experiences with institutional botches and misnomers. These included perceived cover-ups such as Corngate, in which inconsistencies of behaviour were noted and exemplified. In order for a sense of trust to permeate through to the New Zealand public, a sense of behavioural consistency should be promoted by appropriate government bodies.

6.4.3 The Development of an Ethically-Based Assessment Process

One of the key themes that this report covered was the importance of moral issues in judging the acceptability of novel biotechnologies. This emerged through a sense of stewardship and hence accountability for the planet, a sense of responsibility for societal good and a concern for animal and plant welfare. As a result, we feel that participants would like to see more emphasis on bioethics in New Zealand, as promoted by the Bioethics Council. The notion of bioethics should have more importance in the process of decision-making. Moreover, spiritual values other than those attributed to Maori should be integrated into such decision-making processes. New Zealand is increasingly becoming a multicultural country and has a variety of practising and non-practising Christians, Buddhists, Hindus, Muslims and other religions. Moreover, it has a population who think of nature as a complex, interactive system with a certain sacredness about it that demands to be taken into account during decisions about its future. As found in this study, spiritual values are a deep-rooted part of our cultural heritage and can override even the apparent rationality of scientific personnel.

6.5 Limitations of Current Study and Further Research

This report focuses on the complex, multifaceted understandings that the public have of biotechnology and how these were situated in terms of everyday life. Moreover, it has an exclusive concentration upon the roles of nature, spirituality and New Zealand's clean green image in influencing public attitudes towards newly emerging biotechnologies.

Focus groups gave us the opportunity to examine the social processes involved in making decisions about the risks and benefits attributed to novel biotechnologies. People do not make decisions in isolation. However, the emergence of dominant characters during any discussion tends to exclude the voices of other individuals, and to some extent, dictates the themes of the group. However, minority voices can be regained and careful management of the focus group can ensure that their opinions are heard. We acknowledge that the focus group dynamics may generate different accounts when compared to what individuals might say if they were interviewed alone. One way to address the issue is through individual interviews.

The public opinions that we represent in this report are thus locatable in time and space. Moreover, they are examples of "situated knowledges" (Haraway, 1991), produced from the everyday life experiences of members of the New Zealand public and given expression through the focus group process. Public attitudes and values are not the "God trick" (ibid.) of science: the dislocated view from above. They are simply attitudes and values derived from social, environmental, cultural and political interactions. Participants in this study did not lay claim to all-seeing objectivity. Nor do we.

Due to the focused nature of this research, and broad expanse of data left untapped, we feel that a number of methodological and thematic recommendations can be made for further research into this area. We list these below.

Methodologically, it would be useful to re-contact some of the people involved in the focus groups and explore in more depth, some of their comments and understandings through semi-structured interviews. This would be particularly relevant for more socially awkward themes such as the role of spirituality in their decision-making. Perhaps those individuals who were less willing to talk about their views or belief systems might be more willing to disclose information in the 'safe space' of one-on-one contact?

The themes that emerged from this study will also be used as the basis for composing a large-scale national survey across New Zealand. This survey will be more expansive in its recording of public opinions, and allow us to extrapolate findings from the sample to the general population. It may allow us to introduce more exemplars than the focus groups discussions permitted.

A number of avenues for thematic research exist. These include in-depth discussions on the role of animal welfare in decision-making over biotechnology, the relevance of animal-human-plant boundaries in debates over xenotransplantation and genetic engineering, spiritual values other than Christianity and their relationship to other cultural attitudes about biotechnology, and the role of safety and security in determining the acceptability of novel biotechnologies.

Animal welfare featured highly in focus group discussions. This was particularly evident in rural locales among members of the farming community. It is likely that future research

would uncover important issues and concerns relating to animal welfare that influence attitudes towards biotechnology.

Focus group discussions touched on human-animal-plant boundaries, and this issue was greeted with considerable feelings of unease. But why this unease? We have theorised that this is due to the threats to the illusion of self-identity or the autonomous human subject, but a thorough exploration of these feelings of abhorrence would clarify this. Moreover, it would also clarify whether this has altered the degree of identification participants had with non-human others.

Spirituality is a difficult issue to explore, outside of religious practices. However, based on focus group discussions, an exploration of feelings towards the natural environment, would be one means of delving into this little understood area. Concepts such as stewardship, Original Sin and "playing god" could also be investigated using non-sectarian language, to interrogate the idea that these Judeo-Christian values underlie New Zealand belief systems.

Concerns with the safety of novel biotechnologies were a strong feature of focus group discussions, and although they are indirectly discussed in this document, could provide the basis for further research. What constitutes "safe technologies"? How do people draw the boundaries between what is considered safe and what is not? How does this impact on their decision-making? What would make a product safe?

Finally, although we have only really dealt with ethical concerns in this conclusion, focus group data pointed to a public concern with the morality of specific biotechnologies. Participants did not use one ethical stance across the board, but assessed exemplars on a case-by-case basis and often based on personal experience with that particular context. It is this emphasis on personal experience that would be interesting to study, in terms of its influence on the ethical positions of the New Zealand public. How do people address the breaching of the boundaries between human and non-human nature? What ethical approaches do they take to the hybridisation of everyday life in a posthuman/postnatural world?

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Appendix 1
Demographic Survey

Public Perceptions of Recent Changes in Food Production, Medical Technologies and Environmental Management

Lincoln University

Name _____

Age _____

Sex _____

Marital status (please circle)
Married
Live-in partner
Divorced
Separated
Single

Number of children None 1 2 3 4+ (please circle)

Nationality _____

Ethnicity
New Zealand Maori
New Zealand European
Other European
Pacific Islands
Asian
Indian
Other – please identify below

_____

Place of birth (city and country) _____

Employment Status
Self-employed
Full-time salary
Part-time salary
Retired
Full-time home maker
Student
Unemployed
Other beneficiary

Occupation (please name) _____

Income bracket	Under $20, 000
	$21, 000 to $30, 000
	$31, 000 to $40, 000
	$41, 000 to $60, 000
	$61, 000 or more
	Don’t know

Highest educational qualification _____
(please name)

Appendix 2
Phase 1: Focus Group Guide

Part 1 – INTRODUCTION
(approximately 10 minutes)

- Moderator and note-taker introduced as a social researchers from Lincoln University.
- Explain that the moderator will facilitate the discussion and note-taker will listen, take notes and operate the tape recorder.
- Explain the use that will be made of the tape recordings – that they will only be used by the researchers for the purpose of the study, and that absolute confidentiality of participants will be adhered to. No names will be revealed in reports or publications.
- Explain that this research is funded by the Foundation for Research, Science and Technology.
- Repeat that the group will be discussing food, medicine, environment and new developments in agriculture, environmental management and medical therapies.
- Explain that participants should feel free to express their own opinions, that these are important and there are no right or wrong responses to questions.
- State that whilst I have a series of issues to cover, if something participants consider important should develop outside this framework, that we will explore it.

Ice-breaker

Can you briefly introduce yourself and think how would you like to see New Zealand in 20 years time in terms of its agriculture, the food available on the shelves, environment and medical therapies?

Go around the room

Part 2: Meanings of Biotechnology

15 minutes

We're going to be focusing in particular on the topic of new biotechnologies.

To start off, what does the term "biotechnology" mean to you? What words and phrases do you associate with it? What does the term include? What does it exclude?

Write up on chart as spider diagram.

I'm now going to give you a definition of biotechnology. There are a number of definitions, but this one will be used for the purpose of this discussion.

"Biotechnology is a broad term for a group of technologies that are based on applying biological processes. It involves the use of living things or their derivatives to solve problems and make products" (Ministry of Research, Science and Technology).

"….Traditional biotechnologies include fermentation applications such as beer, cheese, breads-making and cosmetics, as well as animal and plant breeding techniques" (Ministry of Research, Science and Technology).

Biotechnologies have been used for a long time period. The term includes the category of genetic engineering, but as you can see, genetically modified organisms just one example of a whole host of biotechnologies.

Could you give me some examples of biotechnologies that you are familiar with?

Write up examples on board and group into agricultural, medical and environmental and misc.

Probe questions for group and individuals

Why did you choose these particular examples?

How do you feel about the way these biotechnologies are heading?
What do you think is the driving force behind these changes?
What concerns do you have about these innovations?

Part 3: Biotechnology Applications

60 minutes

What we're going to do this evening is take a look at some of these new biotechnologies as they relate to agriculture/food production, healthcare and environmental management. But before we do this, I'm going to add to our definition

"Modern biotechnology" includes the commercial use of DNA, genetic engineering, cloning and genetic testing".

Agricultural/Food

(15 minutes)

We just came up with some examples of biotechnologies.

Can you see any particular benefits or drawbacks with the examples you came up with?

(*Go around and write up on board*).

One of the areas of biotechnology people think of is genetic engineering or GMOs.

- Can you tell me what comes to mind when I mention these terms?
- What words and phrases do you associate with them?

(Write up on board)

Provide definition

"Genetic modification" occurs when bacteria, plants or animals have some of their characteristics changed through the manipulation of their genetic makeup.

This may involve changing, deleting or moving genes within them, transferring genes from one species to another, constructing new genes and inserting them into an organism.

I'm going to now give you some examples of biotechnology as it's used in agriculture, and ask a few questions about your opinions on this. Some of the examples will involve GMOS, others will not.

OHP of statements

- A human gene can be inserted into a cow. This cow will now produce a human protein in its milk that is used in the treatment of Multiple Sclerosis. This protein can be harvested and given to people suffering from this illness.

(Explore: cross-species gene transfer; health/moral benefits; use of animals)

- The "good" bacteria found in yoghurt, that helps to strengthen the immune system, can be incorporated into other dairy products such as milk and cheese.

(Explore: inert, switching from one material form to another, not at the genetic level).

- A New Zealand company has developed a means to trace meat products back to their country of origin by checking that the DNA of a meat product matches that of the animal it is supposed to originate from. This means that consumers can be assured of high quality and disease free produce that is associated with New Zealand agriculture (BLIS).

(Explore: DNA useage of genetics in way that benefits non-New Zealanders).

- A synthetic toad gene has been inserted into a potato. This gene carries an antiobiotic toxin from an African toad that may protect potato crops against soft rot.

(Explore: internal gene modification, benefit to crops, economic benefit).

Possible probe questions

- How do you feel about these developments?
- What did you learn from the exemplars that you didn't know before?
- Which ones do you find acceptable? Which aren't?
- You've approved of these, but not these. Why?

Risk/Benefit

- What are the benefits and risks? Who is likely to benefit?
- If I brought some GM apples from Lincoln University, would you try one? What would influence your decision to eat them? Why

Labelling.

- Would you want to see the relevant products labelled as GM? Would you read food labels if you knew that GM foods were to be introduced into New Zealand?

GM

- What do you feel is the main issues concerning GM processes/products?
- If the GM cows and potatoes were located in the Canterbury region how would you feel about it?

Consumption.

- Would you use the products that emanate from these developments? Why? Why not?
- Would you like to see these products in your local pharmacy/on your supermarket shelves/in restaurants? Why? Why not?

Now, we'll move onto the growing field of medical biotechnologies.

Medical

(15 minutes)

There are a number of new medical technologies that have developed over the last few years. These include cloning, genetic testing, xenotransplantation (between animals and humans), and 'pharming' (using livestock for the production of valuable medicines).

- Cells from the pancreases of pigs can be transplanted into people with diabetes. These imported cells allow glucose levels to return to near-normal.

(Explore: xenotransplantation, inter-species, stigma associated with pigs, disease risk, health benefits without insulin dependency).

- Stem cells from a 5 day-old foetus can be inserted into the brain of a person with Alzheimer's disease. This serves to regenerate some of the cells that have been destroyed.

(Explore: stem cells and use of embryos – compare to placenta/bone marrow; ethics; life-saving procedures vs death of embryos).

- A blood sample can be analysed to determine your predisposition towards stomach cancer by identification of specific genes that have been associated with people who develop this condition. This may lead to early detection through annual monitoring of your health.

(Explore: genetic markers; non-invasive; lack of genetic manipulation)

- A farm in North Island has hundreds of cloned New Zealand sheep. A human gene was inserted into them when they were embryos. The insertion of this gene means that these sheep now produce a protein in their milk that can be used for the treatment of cystic fibrosis.

(Explore: cloning (destroy nucleus of egg, replace with another sheeps DNA, and implant into surrogate mother), interaction between cloning and GM, GM for ethical purposes, medical farms).

- A beneficial bacteria found naturally in some peoples saliva has been synthesised and introduced into throat lozenges. A protein produced by this bacteria fights a more harmful form of bacteria that can cause throat infections, rheumatic fever and rheumatic heart disease (BLIS).

(Explore: saliva - synthesised??, naturalness??, minor illnesses to major, can mention dental decay).

Examples

- Can you think of any other examples of these technologies? How would you like to see them used? What would you not like to see?
- What did you learn from the exemplars that you didn't know before?
- What do you feel are the biggest issues with these processes/products?
- How have you made the decision what is acceptable, not acceptable?

Risks/Benefits.

- Who is likely to benefit? What are the benefits and risks?
- To what extent do you think we need to use these techniques in medicare? Any specific cases you would think meritable and others you would not?
- How safe would you feel if you were undergoing these medical therapies? Which ones do you regard as the safest and why?

Consumption

- Would you use the products that emanate from these developments? Why? Why not?
- How would you feel if you found out these treatments were offered in New Zealand? Would you take advantage of them?
- Would you think it necessary to have products labelled?
- Would you like to see these products in your local pharmacy/health centre? Why? Why not?
- Should medicines produced from genetically modified organisms be labelled? Should some products be banned?

Genetics and health

- If a genetic test for something that ran in your family was offered to you free of charge would you take it? Under what conditions?
- If you were offered experimental stem cell therapy as part of a treatment for cancer, under what conditions would you be likely to do it?

- Would you accept stem cells that came from a human foetus? Under what conditions? If there was a more costly alternative, would you be willing to pay for it whether individually or through higher taxes?

Ethical Research?

- What are your feelings towards the use of animals/human embryos in this kind of research?
- What are feelings towards animals in general in New Zealand? Are there any kinds of animal that you would not take a transplant from? If so, why?

Comparisions

- How do you feel about these medical biotechnologies compared to the agricultural biotechnologies we looked at?

Environmental

(15 minutes)

We've looked at some examples of agricultural and medical uses of biotechnology. It is also being used in environmental management. This is predominantly to help clean up contaminated environments (process known as bioremediation) and to help control numbers of unwanted pests (bio-control).

I'm going to give you a few examples now, and I'd like you to have a think about how you feel about them.

- New Zealand's main source of Greenhouse gases comes from methane in the stomachs of sheep. A device inserted into a sheep's stomach that releases a special bacteria, can slow down the methane-producing bacteria and reduce the amount of gas produced.

(Explore: environmental benefits of changing biological processes in sheep, meddling with nature – how natural to have so many sheep in captivity?)

- In order to control the growing possum population, a GM virus can be introduced that will make female possums infertile. This virus will be transmitted among the species and gradually reduce population size without harming the existing population.

(Explore: attitudes towards possums (pests??), perceived benefits to New Zealand's ecology, danger of virus effecting other species, ethical approach versus shooting possums, time-frame).

- A genetically modified bacteria has been developed that helps to remediate New Zealand's soil from the effects of DDE contamination (DDE a toxin produced when the pesticide, DDT breaks down).

(Explore: environmental benefits,

- Grass grubs eat the roots of grasses in NZ, killing them. A bacterium has been grown in fermenters and sold to farmers, who spray it on their paddocks. The bacterium invades

the gut of grass grubs, blocks the absorption of nutrients and starves the grub. It will remain active in the soil for years, avoiding the need for successive re-applications.

(Explore: invasive but more natural? Measures, longevity of biocontrol method, possibility of infecting other species).

General exemplars

- How do you feel about these developments?
- What did you learn from the exemplars that you didn't know before?
- Which technology would you approve of most and least? Why?
- To what extent do you think we need to make these modifications?

Risks/Benefits

- What do you see as the benefits of these environmental biotechnologies? And the potential issues?
- What do you feel is the biggest issue with GM processes/products that are directly used in the environment?
- Who is likely to benefit?
- How would you compare some of these developments in environmental management with those in agriculture and medicine in terms of risk and benefit? Why?

Conditions of release into environment

- Under what conditions would you see them introduced in New Zealand?
- If these environmental management techniques were produced in the Canterbury region how would you feel about it?

Nature

- Do you think these new products will have any impacts on the environment over the long or short term?
- If nature was given a voice, what do you think it would say about these developments? What would New Zealand say?
- To what extent can we make decisions about products that have a direct impact on nature and the environment?

Medical, Agricultural, Environmental

(15 minutes)

Now, we've covered the three main areas of biotechnology. As I said at the beginning, there are a lot of overlaps, and what I want you to do now, is to start thinking about the differences and similarities between these examples.

What I'm going to do now is give you a list of some of the examples we've talked about and ask you to rank them, based on the ones you think are most and least acceptable to you. Those ranked highest should be MOST acceptable, and lowest would be LEAST acceptable. I'm going to hand out some paper and pens and ask you to jot down your thoughts (write names on paper, as I'll collect in). We're then going to attempt to do an overall ranking, based on those individual ones.

Repeat some of the exemplars, but ask them to rank them this time (discussion has already taken place).

- New Zealand's main source of Greenhouse gases come from methane in the stomachs of sheep. A device inserted into a sheep's stomach can slow down the methane-producing bacteria and reduce the amount of gas produced (MORST).

- A beneficial bacteria found naturally in some peoples saliva has been synthesised and introduced into throat lozenges. A protein produced by this bacteria fights a more harmful form of bacteria that can cause throat infections, rheumatic fever and rheumatic heart disease (BLIS).

- A synthetic toad gene has been inserted into a potato. This gene carries an antiobiotic toxin from an African toad that may protect potato crops against soft rot.

- Stem cells from a 5 day-old foetus can be inserted into the brain of a person with Alzheimer's disease. This serves to regenerate some of the cells that have been destroyed.

- A genetically modified bacteria has been developed that helps to remediate New Zealand's soil from the effects of DDE contamination (DDE a toxin produced when the pesticide, DDT breaks down).

Come back to selected exemplars.

Ask participants to rank them individually (provide paper) and as a group.

(Be aware of the group process of ranking them).

Why have you ranked these examples in this order? What has influenced you in this choice?

(Probes at underlying values particular to each person)

Part 4: The Future of Biotechnology?

(10 minutes)

Many discussions on biotechnologies have focuses on looking at their risks, benefits and acceptability, as we have done. However, I want to end this discussion by moving back to the beginning.

Put up OHP of initial thoughts.

- What kind of New Zealand do we want to see in 20 years time?
- After this discussion, have your thoughts changed at all?
- Who should be benefiting from these new biotechnologies and how can we make sure that happens?

Appendix 3
Focus Group Guide – Phase II

Part 1 – INTRODUCTION
(approximately 10 minutes)

Introduction

- Moderator and note-taker introduced as a social researchers from Lincoln University.
- Explain that the moderator will facilitate the discussion and note-taker will listen, take notes and operate the tape recorder.
- Explain the use that will be made of the tape recordings – that they will only be used by the researchers for the purpose of the study, and that absolute confidentiality of participants will be adhered to. No names will be revealed in reports or publications.
- Explain that this research is funded by the Foundation for Research, Science and Technology.
- Explain that we have already talked to two groups and this is a chance to follow up on some of the issues they raised. Agenda dictated by this.
- Repeat that the group will be discussing food, medicine, environment and new developments in agriculture, environmental management and medical therapies.
- Explain that participants should feel free to express their own opinions, that these are important and there are no right or wrong responses to questions.
- State that whilst I have a series of issues to cover, if something participants consider important should develop outside this framework, that we will explore it.

Ice-breaker

Can you say your name and think about how you would like to see New Zealand in 20 years time? Think about this in terms of its agriculture, the food available on the shelves, environment and medical therapies?

Part 2: Meanings of Biotechnology

15 minutes

We're going to be focusing in particular on the topic of new biotechnologies. **To start off, what does the term "biotechnology" mean to you? What words and phrases do you associate with it? What does the term include? What does it exclude?**

Write up on chart as spider diagram.

I'm now going to give you a definition of biotechnology. There are a number of definitions, but this one will be used for the purpose of this discussion.

"Biotechnology is a broad term for a group of technologies that are based on applying biological processes. It involves the use of living things or their derivatives to solve problems and make products" (Ministry of Research, Science and Technology).

Biotechnologies have been used for a long time period. For instance, traditional biotechnologies include fermentation for beer, bread-making, and animal and plant breeding techniques. The term now includes the category of genetic engineering, but as you can see, genetically modified organisms just one example of a whole host of biotechnologies.

Probe questions for group and individuals
How do you feel about the way these biotechnologies are heading?
What do you think is the driving force behind these changes?
What concerns do you have about these innovations?

During our initial focus groups, there were a few general themes that emerged, and what we will do for he remainder of the time is to go through these themes. I will present you with some examples, quotes and a few questions.

Part 3: Comparative Analysis

What I'm going to do first is give you a list of some examples of modern biotechnology and ask you to rank them, based on the ones you think are most and least acceptable to you. Those ranked (1) should be MOST acceptable, and (5) would be LEAST acceptable. I'd also like you to jot down the reasons you placed the examples in that order and we'll go through that in a short period of time.

Read the exemplars, and ask them to rank them. (GIVE OUT SHEET OF PARTS A, B, C).

- New Zealand's main source of Greenhouse gases come from methane in the stomachs of sheep. A device inserted into a sheep's stomach can slow down the methane-producing bacteria and reduce the amount of gas produced (MORST).

- A beneficial bacteria found naturally in some peoples saliva has been synthesised and introduced into throat lozenges. A protein produced by this bacteria fights a more harmful form of bacteria that can cause throat infections, rheumatic fever and rheumatic heart disease (BLIS).

- A synthetic toad gene has been inserted into a potato. This gene carries an antibiotic toxin from an African toad that may protect potato crops against soft rot.

- Stem cells from a 5 day-old embryo can be inserted into the brain of a person with Alzheimer's disease. This serves to regenerate some of the cells that have been destroyed.

- A genetically modified bacterium has been developed that helps to remediate New Zealand's soil from the effects of DDE contamination (DDE a toxin produced when the pesticide, DDT breaks down).

Ask participants to rank them individually (provide paper) and as a group.

(Be aware of the group process of ranking them).

Why have you ranked these examples in this order? What has influenced you in this choice?
(Probes at underlying values particular to each person)

Part 4: Themes

During the first stage, a number of themes/issues came up during discussion. What we're going to do now is focus on some of these themes and the first one we'll look at is biotechnology and nature.

Nature/Nurture

This idea of the natural/unnatural constantly emerged throughout the first 2 focus groups. Why do you think it is so important to people when we're looking at (the status of) biotechnology?

In our previous focus groups a number of people saw biotechnology as disturbing or meddling with nature.

- Is a potato with a toad gene in it still a potato? It looks like a potato, but is it?
- I think there is a risk of perverting nature.
- "Even scientists don't know what they don't know".
- I find it creepy when you're moving across animal-human boundaries. It just makes my skin crawl.

On the other hand, it was pointed out that:

- This isn't really much different from what we've been doing before.
- If we are part of nature, then is what we're doing not natural as well?

What do you think about these comments?

Probe Questions

Why do you think people made them? What are they getting at/trying to say?

Themes

We're going to now have a look at some final examples of other biotechnologies, and rather than doing an individual ranking, I want you to think about them specifically in terms of how natural each example is, and how safe each example is…

- **How natural do you think the following examples are? What makes some more natural/unnatural than others? What is it that makes it unnatural?**
- **How safe/risky are these examples? What do you think the risks are from each of these technologies? In terms of personal, social and environmental risk? Which ones do you think are the most safe? Why? What makes some safer than others? How safe is it to introduce these new biotechnologies into New Zealand? What would we have to do to make these processes safe for humans, animals, and the environment?**

- **Are there any other factors that have an impact on how acceptable you find these? What are they?**

- A blood sample can be analysed to determine your predisposition towards stomach cancer by identification of specific genes that have been associated with people who develop this condition. This may lead to early detection through annual monitoring of your health.

- In order to control the growing possum population, a **GM virus** can be introduced that will make female possums infertile. This virus will be transmitted among the species and gradually reduce population size without harming the existing population.

- Cells from the pancreases of **pigs** can be transplanted into people with diabetes. These imported cells allow glucose levels to return to near-normal.

- A farm in North Island has hundreds of cloned New Zealand sheep. A human gene was inserted into them when they were embryos. The insertion of this gene means that these sheep now produce a protein in their milk that can be used for the treatment of cystic fibrosis.

Part 5: Future of Biotechnology

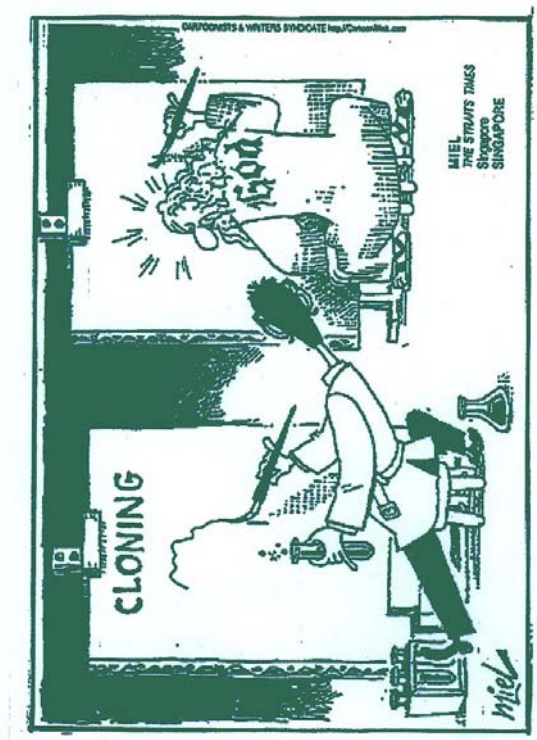
We're going to end by looking at the future of biotechnology in New Zealand. Here are two more statements.

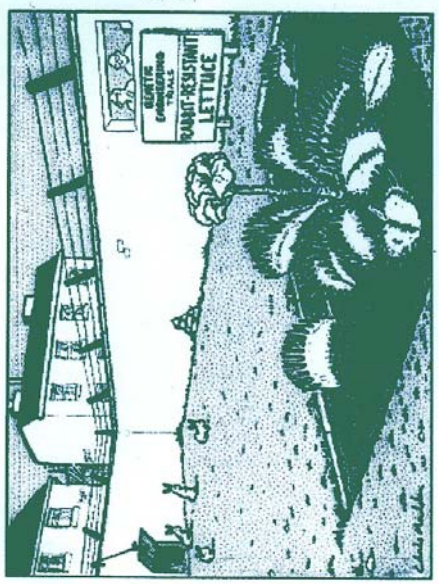
New Zealand is known for its innovations. It is the perfect laboratory in which to introduce new biotechnologies, for it's an isolated island with a small, homogeneous population and has no major animal disease. If we distance ourselves from the biotechnology market, it will be our economic downfall.

As an island miles form anywhere else, New Zealand can distance itself from any potential problems that might arise from the use of new biotechnologies. We should remain "clean and green" and go back to working with nature, rather than against it.

What do you think about these two polarised statements? Can a compromise be reached?
Where do you think New Zealand should head in terms of biotechnology?

Appendix 4
Biotechnology Cartoons





Appendix 5
The Human Milk-Machine

Mothers Against Genetic Engineering in Food and the Environment (MAdGE)

Downloaded from: http://www.madge.net.nz/doclibrary/cindy_photos/billbrd_large.jpg