

The impact of patents on New Zealand's biotechnology and genetics services sectors

Aphra Green

A thesis submitted for the degree of Master of Laws

at the University of Otago, Dunedin, New Zealand

Date: 30 June 2008

Abstract

Concerns have been expressed, both nationally and internationally, regarding the impacts of patents, and particularly gene patents, on the genetics services and biotechnology research sectors. In particular, there is evidence that patents may be hampering the provision of clinical genetic testing services (in the United States at least), and it is argued that broad patents and increasing numbers and complexity of patents in the biotechnology field can hamper innovation and research. However, there is also evidence that patents provide a strong incentive to innovate in the areas of biotechnology and genetics, as compared with other fields and with other mechanisms used to capture the benefits of innovation (such as secrecy, lead time, complementary manufacturing capability, and complementary sales and service effort).

In 2003, an Australian biotechnology company, Genetic Technologies Ltd (GTG), approached the New Zealand health sector and a number of life science organisations requesting licence fees for the use of its patents on non-coding DNA analysis and mapping. The parties involved filed proceedings in court and the case was eventually settled with a license agreed upon. However, there was very little existing evidence on the extent to which the GTG case indicated wider problems with patents in the New Zealand genetics services and biotechnology research sectors. The Government policy response was therefore largely based upon this single case.

I undertook this research over 2007 and 2008 to investigate both the positive and negative impacts of patents in New Zealand's genetics services and biotechnology sectors. This research involved an initial analysis of numbers and types of patents that have been granted in New Zealand in the areas of genetics and biotechnology, an online survey of genetics services and biotechnology research organisations, and a small number of informal follow-up interviews with survey participants to discuss themes emerging from the online survey.

It was initially hypothesised that the increased complexity of the patent landscape and the licensing practices of particular patent owners may be having an overly negative effect on New Zealand's biotechnology and genetic services sectors, particularly given the smaller size and limited resources of most of the organisations within these sectors.

However, my research found that:

- many patents, including a number of patents identified as 'problematic' elsewhere, have not been filed or granted in New Zealand, and if granted are not currently being enforced;
- those patents that have been granted are having no impact on the provision of genetic testing in the genetics services sector at present;
- there were some areas of concern expressed by respondents in the biotechnology sector, but overall patents are not having an overly negative impact on research at this stage; and
- patents provide an important avenue for New Zealand biotechnology organisations to capitalise on their discoveries, and appear to be used to good effect by the New Zealand biotechnology organisations surveyed.

I speculate that those patents that have been granted in New Zealand are not being enforced due to New Zealand's relative isolation and small target market size. The lack of large-scale private genetic testing services may also be discouraging patent holders from enforcing their patents against New Zealand's small public health system. At this stage, these factors are protecting the New Zealand biotechnology and genetics services sectors. However, there is some evidence to suggest that this situation is changing, with many international companies beginning to file and enforce their patents in New Zealand. Government agencies must monitor developments in this area to ensure that New Zealand biotechnology companies can continue to access necessary

intellectual property and carry out research uninhibited by problematic patents and/or licensing practices. There is also potential for collaboration between research organisations to reduce the transaction costs associated with searching for and assessing existing patents.

There is reason to monitor developments in the genetics services sector also, particularly for potential costs to testing laboratories arising from future license fees and royalties. Should New Zealand genetics services be faced with future licensing demands, the collaboration mechanisms used in the GTG case should be used again to secure the best bargaining position possible (and therefore likely the best licensing deal).

Finally, I do not recommend any changes to the law arising out of the results of my research, for the main reason that many of the issues relating to patent validity (in particular, novelty, utility and breadth) will be addressed by the enactment of the Patents Bill. In particular, the Bill introduces more explicit criteria for patentability and increases the stringency test to one of a “balance of probabilities”. Once the Patents Bill has been enacted, researchers must be advised of the scope and effect of the research exemption to ensure that there is clarity around the status of research carried out in the biotechnology sector.

Acknowledgments

First and foremost, I would like to thank Richman Wee (Project Manager of the Human Genome Research Project) and Mark Henaghan (Project Leader and my Supervisor) for their tireless support and encouragement throughout this research, and for providing me with the opportunity to work on the Human Genome Research Project. The Human Genome Research Project is funded by the Law Foundation, to which I am also very grateful. My part-time employment as a Research Fellow with the Project, as well as a University of Otago Postgraduate Award kept me fed and clothed for the year.

I am also very grateful to Dianne Nicol and Jane Nielsen for providing me with their survey and interview questions they used in their Australian research on a similar topic, and for reviewing my draft survey prior to it being distributed. Parry Guilford, Research Director at Pacific Edge Biotechnology and Claire Turner, former geneticist with Central and Southern Regional Genetics Service also both reviewed the survey prior to its distribution. I am especially indebted to John Hobbs, Principle Advisor at the Ministry of Health and previously Manager, Strategic Policy on Ethics and Innovation (and therefore involved in the GTG case) who painstakingly reviewed a full draft of this thesis, and suggested many valuable changes.

Many people in a number of Government agencies gave their time to provide me with information. I would particularly like to thank Jess Doube, Policy Analyst and Wendy Brandon, then Acting Chief Legal Advisor at the Ministry of Health; Bruce Northey, General Counsel at Auckland District Health Board; Stephen Gray, Analyst at the Ministry of Research, Science and Technology; Rebecca Dowdle, Senior Patent Examiner at IPONZ; and Warren Hassett, Senior Analyst at the Ministry of Economic Development.

This research would not have been possible without the tolerance and cooperation of the survey and interview participants – all of whom gave generously of their time and knowledge.

On a more personal note, I would also like to acknowledge the various residents of our house – my flatmates Tim and Ari, cheers for the good company and good food. And Jacob, my dearest, thank you for your patience, support and good humour. Finally, my sweet cat Nina accompanied me on most of this journey, most often sleeping on my desk. I'm grateful to have been able to spend so much time with her in what was to be the last year of her life.



Contents

Abstract	i
Acknowledgments	iv
List of Tables	x
List of Figures	x
List of Abbreviations	xi
1 Introduction	12
1.1 <i>Research methodology</i>	14
1.2 <i>Scope</i>	15
1.3 <i>Structure of this thesis</i>	16
2 Context	17
2.1 <i>Genetics services in New Zealand</i>	17
2.2 <i>New Zealand's biotechnology sector</i>	21
2.3 <i>New Zealand's patent system</i>	22
2.3.1 <i>Patents Act 1953</i>	22
2.3.2 <i>Patents Bill</i>	23
2.4 <i>Genetic Technologies Ltd (GTG)</i>	26
2.5 <i>Literature summary</i>	28
2.5.1 <i>Predominant causes for concern</i>	28
2.5.2 <i>Impacts of patents on clinical genetic testing services</i>	35
2.5.3 <i>Impacts of patents on biotechnology research</i>	41
2.5.4 <i>Impacts of patents on innovation</i>	47
2.6 <i>Implications for this research and research questions</i>	51
3 Methodology	55
3.1 <i>Introduction</i>	55
3.2 <i>Ethical approval</i>	56
3.3 <i>Database construction</i>	56
3.4 <i>Distribution</i>	58
3.5 <i>The survey</i>	59
3.6 <i>Follow-up interviews</i>	60

4	Results	62
4.1	<i>Summary</i>	62
4.2	<i>Response rate</i>	64
5	Clinical genetics services	68
5.1	<i>Profile</i>	68
5.2	<i>Licensing in</i>	69
5.3	<i>Difficulties with access</i>	70
5.4	<i>Patent searching</i>	72
5.5	<i>Attitudes towards patenting</i>	75
6	Research organisations	79
6.1	<i>Profile</i>	79
6.2	<i>Licensing in</i>	80
6.3	<i>Impacts of licensing practices of patentees</i>	82
6.3.1	<i>Notifications</i>	82
6.3.2	<i>Breakdowns or delays in licence negotiations and difficulties licensing-in</i>	83
6.3.3	<i>Refusals to licence</i>	84
6.4	<i>Anticommons issues</i>	85
6.4.1	<i>Patent searching practices</i>	86
6.4.2	<i>Effect of existing patents on choice of research</i>	90
6.4.3	<i>Research not commenced</i>	92
6.4.4	<i>Research changed or discontinued</i>	93
6.4.5	<i>Royalty stacking and reach-through rights</i>	94
6.5	<i>Patenting practices</i>	95
6.6	<i>Licensing out</i>	99
6.7	<i>Incentive effects of patents in the biotechnology sector</i>	101
6.8	<i>Attitudes towards patents</i>	104
7	Other organisations	108
7.1	<i>Profile</i>	108
7.2	<i>Attitudes towards patenting</i>	109
7.2.1	<i>Costs of research</i>	110

7.2.2	<i>Ability to do research</i>	110
7.2.3	<i>Sharing of information</i>	111
7.2.4	<i>Quality of testing</i>	111
7.2.5	<i>Ability to develop a test</i>	111
7.2.6	<i>Costs of testing to laboratories and patients</i>	113
7.2.7	<i>Accessibility of genetic testing</i>	113
7.2.8	<i>Impact of patenting biotechnology inventions</i>	113
7.2.9	<i>Effect of broad patents on research</i>	114
8	Legal and structural approaches to patent problems	115
8.1	<i>Legal approaches</i>	115
8.1.1	<i>Compulsory licences and Crown use provisions</i>	116
8.1.2	<i>Exclusions from patentability</i>	118
8.1.3	<i>Experimental use exemption</i>	122
8.1.4	<i>Structural solutions</i>	128
9	Conclusion	131
9.1	<i>The aims and objectives of this research</i>	131
9.2	<i>Conclusions</i>	133
9.3	<i>Recommendations</i>	138
9.4	<i>Limitations</i>	140
9.5	<i>Recommendations for future research</i>	143
	Bibliography	145
	Appendix One	161
	<i>Gene patents</i>	161
	<i>Analysis of gene patents and research tool patents granted in New Zealand as compared with overseas jurisdictions</i>	170
	Appendix Two	180
	<i>Full text of online survey</i>	180
	Appendix Three.....	202
	<i>Interview topics – genetics services</i>	202
	<i>Interview topics – biotechnology research participants</i>	203
	Appendix Four	205

<i>Ethical approval form</i>	205
Appendix Five	207
<i>Case studies: GTG and Myriad</i>	207
Appendix Six.....	230
<i>History and development of the experimental use exemption</i>	230
<i>Safe harbour or regulatory review exception</i>	240

List of Tables

Table 1: Total organisations emailed, number of individual emailed in those organisations, and response rate by individual response	65
Table 2: Total respondents	67
Table 3: Patents relating to genetic tests in New Zealand and the United States	171
Table 4: Patents on research tools in Australia and New Zealand.....	174

List of Figures

Figure 1: Views of providers of genetics services	76
Figure 2: Views of researchers on impacts of patents	105
Figure 3: Views of 'others' on impacts of patents	109

List of Abbreviations

CRI – Crown Research Institute

DHB – District Health Board

DTC – Direct-to-Consumer (marketing or supply of genetic tests)

EPO – European Patents Office

GTG – Genetic Technologies Ltd

IPONZ – Intellectual Property Office of New Zealand

OECD – Organisation for Economic Cooperation and Development

OTL – Stanford Office of Technology Licensing

PCT – Patent Cooperation Treaty

RCPA – Royal College of Pathologists of Australasia

SC – United States Supreme Court

TRIPs – Agreement on Trade-Related Aspects of Intellectual Property Rights

USPTO – United States Patents and Trademarks Office

WARF – Wisconsin Alumni Research Foundation

WTO – World Trade Organisation

1 Introduction

Both in New Zealand and internationally there has been debate about the effects of patents, and particularly gene and broad research tool patents, on the genetic services and research sectors. However, the extent of these effects in the New Zealand genetics services and biotechnology sectors is not well known. This research sought to gain insight into both the positive and negative impacts of patents on the biotechnology and genetics services sectors in New Zealand, by gathering information from those directly involved in each sector.

The patent system is intended to reward innovation by providing an inventor with the right to exclude others from making, using or selling the invention for a limited time (usually 20 years). In return, the details of the invention are placed in the public domain, thereby furthering potential innovation in the field by encouraging patent holders to 'invent around' a patent. Growth in the number of biotechnology patents combined with a trend towards patents on 'upstream' research tools and products have led to concerns that difficulties with access to such patents may stifle innovation or reduce access to clinical genetic testing services.¹

Despite a proliferation of opinion on the topic internationally (particularly in relation to the impact of gene patents²), only a small number of empirical studies

¹ Nicol and Nielsen also note two other factors that have contributed to the increasing complexity of the patent landscape: (1) an increase in the number and diversity of companies and other industry players filing patents; and (2) the filing of defensive patents in respect of a single invention to create a "picket fence" around particular key technologies: Dianne Nicol and Jane Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry," (Hobart, Tasmania: Centre for Law and Genetics, 2003).

² See, for example: Australian Law Reform Commission, "Genes and Ingenuity: Gene Patenting and Human Health," (Sydney, NSW: 2004), Timothy Caulfield, "Genetic Testing, Ethical Concerns, and the Role of Patent Law," *Clinical Genetics* 57, no. 5 (2000), Timothy Caulfield et al., "Evidence and Anecdotes: An Analysis of Human Gene Patenting Controversies," *Nat Biotech* 24, no. 9 (2006), Graeme Dutfield, "DNA Patenting: Implications for Public Health Research," *Bulletin of the World Health Organisation* 84, no. 5 (2006), Kathryn Garforth, "Health Care and Access to Patented Technologies," *Health Law Journal* 13 (2005), Michael A. Heller and Rebecca S. Eisenberg, "Can Patents Deter Innovation? The Anticommons in Biomedical Research,"

exist on the impacts of patents on the genetic services and biotechnology research sectors.³ Evidence from these studies suggests that, while the patent landscape has certainly become more complex, practical means are being used to overcome barriers to innovation. However, there is evidence to suggest that in the United States, particular patents and licensing practices may be preventing some genetic tests from being offered.

In New Zealand, these issues came to prominence when Genetic Technologies Ltd (GTG), an Australian biotechnology company, began enforcing its patents on methods of analysis of non-coding DNA against organisations carrying out research and providing clinical genetic testing services. The extent to which the GTG case indicated wider problems with patents in the genetics services and biotechnology research sectors was relatively unknown.

The New Zealand Government, like other governments worldwide, is promoting and funding biotechnology as a key area of growth, destined to underpin the development of the New Zealand economy. This research was therefore undertaken with the aim of providing further information for the New Zealand health and biotechnology sectors in answer to the question aptly put by Tim Caulfield: "Is the right balance being struck?"⁴ This is the balance between encouraging innovation on the one hand, and continuing to provide, on a public model, free and easily accessible healthcare for those in need. At a more basic

Science 280, no. 5364 (1998), Jon F. Merz and Mildred K. Cho, "What Are Gene Patents and Why Are People Worried About Them?" *Community Genetics* 8 (2005), Nuffield Council on Bioethics, "The Ethics of Patenting DNA: A Discussion Paper," (2002), Organisation for Economic Cooperation and Development, "Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies," (2002).

³ Mildred K. Cho et al., "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services," *Journal of Molecular Diagnostics* 5, no. 1 (2003), Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry," Joseph Straus, Henrik Holzapfel, and Mattias Lindenmeir, *Genetic Inventions and Patent Law: An Empirical Survey of Selected German R&D Institutions* (Munich: Verlag Medien Design, 2004), John P. Walsh, Ashish Arora, and Wesley M. Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation," in *Patents in the Knowledge-Based Economy*, ed. Wesley M. Cohen and Stephen A. Merrill (Washington, DC: National Academies Press, 2003).

⁴ Timothy Caulfield, "Policy Conflicts: Gene Patents and Health Care in Canada," *Community Genetics* 8, no. 4 (2005).

level, it must be recognised that biotechnology and the genetics services sector are two sides of the same coin. Innovation in biotechnology has lead directly to developments in the genetics services sector, simply in terms of genetic tests rapidly becoming available. While obviously “biotechnology” has many fields and areas of research, in no other field of biotechnology has there been so rapid a transition from laboratory to clinical application than in the field of genetics. Patents have the potential to impact both positively and negatively on both sides of this coin, so it was therefore necessary to investigate issues for both sectors.

This research therefore focused on:

- the extent to which genetic services and research organisations in New Zealand are affected by the increasing complexity of the patent landscape;
- whether New Zealand genetic services and research organisations are affected by the particular patents and licensing practices that have been identified as ‘problematic’ overseas; and
- the patenting and licensing practices of New Zealand biotechnology organisations.

1.1 Research methodology

As the aim of this research was to investigate the impact of particular legal structures and tools, it was considered important to collect information direct from the sectors that were focused on. A qualitative approach was preferred due to the small sector size and the need to account for anecdotal evidence and the personal views of participants. An online survey of the genetics services and biotechnology research sectors was chosen due to the ease of administration of the survey (potential participants were spread nationally) and due to the possibility for online surveys to increase survey participation. A survey also allows gathering of initial data, from which emerging themes can be identified.

Themes that emerged from the survey were discussed further in follow-up interviews with a small number of survey participants.

1.2 Scope

This research was originally conceived with the intent of determining the effects of “gene patents” on the healthcare and research sectors. After initial scoping research, it seemed that many of the problems associated with gene patents also applied to a number of research tool and other patents in the medical biotechnology sector.

While there are particular ethical and legal issues associated with granting patents on genetic material, problems of breadth and one-use/all-use claims are not limited to these patents. In addition, while in some cases it is the patent claims themselves that cause the problem, in others it is the licensing practices employed by patent owners. As discussed below, sheer numbers and complexity of patents in the area of biotechnology have been a cause for concern.

In addition, given the small size of New Zealand’s research sector, and from an initial analysis, it appeared that there may in fact be very few (or no) gene patents having an impact in New Zealand.⁵ This research was therefore broadened to take account of patents more generally, and their impact on the genetics services and the biotechnology research sectors of New Zealand, while retaining some focus on gene patents. This thesis therefore briefly covers some of the particular issues surrounding patents on genetic material, and investigates the impacts of all types of patents on the provision of genetic testing and on biotechnology research in New Zealand.

⁵ However, the most common group of technologies used by the biotechnology sector are those in the DNA area.

1.3 *Structure of this thesis*

This thesis is broadly divided into two parts. The first part (chapter 2) examines:

- the legal and structural context;
- the GTG case and its impact on New Zealand law and policy; and
- previous research in the area.

The second part of this thesis (chapters 3 to 7) discusses qualitative research undertaken with New Zealand's genetics services and biotechnology sectors to investigate the issues summarised above. Chapter 8 examines legal and structural approaches used to overcome problems with patents in this area, particularly the proposed introduction of a statutory experimental use exemption into New Zealand's patent law. Chapter 9 draws some conclusions and makes recommendations from the findings of this research.

2 Context

This chapter provides contextual information on New Zealand's genetics services and biotechnology sectors. The requirements for patentability in the Patents Act 1953 are summarised and compared with the changes to these requirements and other features as outlined in the new Patents Bill. The salient features of the GTG case are also briefly summarised. The final parts of this chapter analyse the evidence on the impact of patents on genetics services and biotechnology research, and the evidence that patents play a strong role in incentivising innovation in the biotechnology sector. The chapter concludes with a summary of the implications of this evidence for my research and outlines the research questions to be addressed.

2.1 Genetics services in New Zealand

Genetics services in New Zealand are divided into two areas of responsibility. The Northern Regional Genetics Service (RGS) covers the northern two-thirds of the North Island, and the Central and Southern RGS covers the rest of New Zealand (from New Plymouth to Invercargill). The Services take a holistic approach to patient care, viewing the genetic test as secondary to counselling and follow-up care. Patient care, informed consent and equity of access are also viewed as very important by those working within the Services.⁶ The Services hold outreach clinics in smaller towns and cities, which ensures access to counselling for patients living in more remote areas. However, the two Services operate relatively independently, and are each responsible for sourcing the laboratory testing that they require at a competitive price.

⁶ Anne Scott and Rosemary Du Plessis, "Redefining a Technology: Public and Private Genetic Testing in New Zealand" (paper presented at the Medicine and the Body Politic, University of Brighton, United Kingdom, 21-22 September 2006)., p. 7.

There are currently four different laboratories offering diagnostic genetic testing in New Zealand for around 75 disorders.⁷ The two main laboratories are: LabPlus, based in Auckland City Hospital and Canterbury Health Laboratories, in Christchurch. Canterbury Health Laboratories collaborates with the Christchurch School of Medicine and Health Sciences, which offers predictive genetic testing for retinoblastoma.⁸ The other two laboratories, based in Wellington and Dunedin, offer a small number of specialised genetic tests.⁹ LabPlus is part of Auckland District Health Board and provides molecular genetic testing to ADHB and as requested by other DHBs and both Northern and Central/Southern RGS. When a test is referred to LabPlus, it then carries out the test or sources it externally. LabPlus also accepts test referrals from other health professionals (throughout the health sector) and also occasionally from clinical geneticists overseas. As the Central and Southern RGS does not have a large laboratory within its host DHB (Capital and Coast), it is responsible for outsourcing the laboratory tests required, either from another laboratory in New Zealand (such as LabPlus), or overseas.¹⁰ Where a test is not available or is in New Zealand, it may be sent overseas.

There is no formal process for the validation and selection of genetic tests in New Zealand. The most common reasons for the selection of genetic tests are clinical demand, areas of individual interest (within laboratories), and level of funding.¹¹ Research interests of university laboratories (such as the Christchurch School of Medicine and the University of Otago) also have some bearing on the availability of particular genetic tests. For example, the Cancer Genetics Laboratory at the

⁷ World Health Organisation Genomic Resource Centre, *Case study: New Zealand*, available at <http://www.who.int/genomics/policy/newzealand/en/index.html>, accessed 2 August 2007.

⁸ See, for example, <http://www.chmeds.ac.nz/research/retinoblastoma/index.htm>, accessed 15 July 2007.

⁹ Human Genetics Society of Australasia, *DNA Diagnosis of Genetic Disorders in Australasia*, updated 31 January 2007, www.hgsa.com.au, accessed 2 March 2007.

¹⁰ For the Central and Southern RGS, it is often more cost effective for tests to be sent overseas, even where they are offered in New Zealand: Joanne Dixon, 2008.

¹¹ Diana Sarfati, "Some Practical Aspects of Genetic Testing in New Zealand: A Report for the National Health Committee," (2002), p. 8.

University of Otago offers genetic testing within its research areas (Drash and WAGR Syndrome testing, and IGF2 overgrowth disorder).¹²

Most genetic testing carried out in New Zealand is concerned with inherited, fairly rare disorders caused by a single gene or chromosome that results in a specific medical condition. Genetic testing in the New Zealand context¹³ is used to:

- confirm a diagnosis where symptoms already exist (diagnostic genetic testing);
- indicate whether someone with a family history of late-onset disease is likely to develop the disease (predictive genetic testing);
- screen before birth for genetic disorders such as Down's Syndrome (prenatal genetic testing);¹⁴ and
- check whether someone is a carrier for a recessive disorder, such as cystic fibrosis (carrier testing).¹⁵

A significant proportion of genetic tests are ordered by non-geneticists, including general practitioners and in particular, specialists in paediatrics, oncology, haematology, obstetrics, and neurology.¹⁶ Laboratories charge a price per test,

¹² Human Genetics Society of Australasia, "DNA Diagnosis of Genetic Disorders in Australasia," (January 2007), University of Otago, "Cancer Genetics Laboratory Website," (2006).

¹³ New uses of genetic testing, particularly in the area of pharmacogenomics, are still some way off. The drug trastuzumab, marketed under the name Herceptin, is currently the only example of where a genetic test can be used to determine the likely efficacy of the drug. A genetic test is not absolutely necessary however, as the overproduction of HER2 receptors (the drug target) can be visualized on the surface of the tumour: Roche, "Pharmacogenomics: Genes and Drug Response," (http://www.roche.com/pages/facets/22/pharmacogen_e.pdf).

¹⁴ National Advisory Committee on Health and Disability, "Molecular Genetic Testing in New Zealand," (Ministry of Health, 2003), p. 12. Preimplantation genetic diagnosis is now also available (and publicly funded) in some circumstances: Human Assisted Reproductive Technology Order 2005.

¹⁵ This type of testing has the lowest priority, and is usually only carried out if a couple is planning to conceive and have a history of a specific genetic disorder in their family: personal communication, Joanne Dixon.

¹⁶ National Advisory Committee on Health and Disability, "Molecular Genetic Testing in New Zealand," p. 21. A survey of 328 GPs found that approximately one-third had referred a patient or ordered a genetic test once or more in the previous year from patients with either thrombophilia (38%), breast cancer (40%), or cystic fibrosis (34%). Fifty percent of GPs had ordered more than one test for haemochromatosis in the previous year, and a further 20% of GPs had ordered at

which will vary depending on the test, whether it is sent overseas, and the amount of profit for the laboratory that is built into the price. Very few tests are provided privately in New Zealand, so DHBs fund and provide most genetic tests.

However, private genetic testing for a number of conditions is now being offered by a number of overseas companies who advertise on the internet.¹⁷ A company set up by Auckland Uniservices and Diagnostic Medlab, DNA Diagnostics, offers paternity testing (\$1125), DNA extraction, profiling and storage for 5 years (\$350), twin zygosity (\$168.75), and consultancy (\$168.75 per hour).

GTG has also previously offered private genetic testing services direct to some GPs and specialists. In early 2004, GTG sent letters and brochures advertising commercial genetic testing to most New Zealand oncologists, some gastroenterologists and some GPs. In a newsletter to GPs following GTG's approach, the College of GPs passed on the Ministry of Health's concerns about the "significant technical, social, ethical, safety and costs issues associated with genetic susceptibility testing". The Ministry advised practitioners to ensure that they are aware of these issues, or to seek specialist advice before referring patients for any genetic tests. It is difficult to know how many health practitioners have used GTG's services.¹⁸ GTG responded to the concerns by asserting that they could deliver a faster service, relied on doctors for referrals, and offered tests that might not otherwise be available to some people in the public system. As discussed below (section 2.5.2) direct-to-consumer and direct-to-doctor marketing of genetic tests raise a number of ethical and safety issues.

least one test. However, most GPs had never ordered or referred for testing patients with Huntington's disease (74%) or myotonic dystrophy (81%). See Sonya Morgan et al., "Genetic Testing in New Zealand: The Role of the General Practitioner," *New Zealand Medical Journal* 117, no. 1206 (2004).

¹⁷ See, for example, www.dnadirect.com (offers a range of genetic tests, most of which can be ordered without pre-test counselling), www.dnabioservices.co.nz (paternity testing), www.dnaconsultants.com (family history reports), www.23andme.com, as well as many others.

¹⁸ Martin Johnston, "Costly Genetic Tests for Cancer Worry Specialists," *New Zealand Herald*, 4 March 2005.

2.2 New Zealand's biotechnology sector

The New Zealand Government has identified biotechnology¹⁹ as a key area for investment, and pivotal in the growth of the New Zealand economy – largely due to the ability of biotechnology to improve upon key primary produce exports. Since 2002, there have been a number of Government publications on the biotechnology industry,²⁰ and in 2003 the Biotechnology Taskforce made a number of recommendations designed to enhance the growth of the New Zealand biotechnology sector. In May 2003, in response to a recommendation of the Royal Commission on Genetic Modification,²¹ the Government released the New Zealand Biotechnology Strategy, outlining the Government's vision and direction for the development of biotechnology in New Zealand.²² The Roadmap for Biotechnology Research sits under the Biotechnology Strategy, and recognises the role of biotechnology research in New Zealand.

For 2004-05, the Government spent \$195 million on biotechnology research, which was 25% of total government research and development investment (proportionally the highest share of all public sector research and development expenditure on biotechnology research in the OECD).²³ The Government is

¹⁹ The OECD defines biotechnology as "the application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services": Organisation for Economic Development and Cooperation, *Glossary of Statistical Terms*: <http://stats.oecd.org/glossary/detail.asp?ID=219>, accessed 23 February 2008.

²⁰ Ministry of Economic Development, "The Growth and Innovation Framework Sector Taskforces: Progress with Implementation - 2005 Report," (2005), Ministry of Research Science and Technology, "The Biotechnology Research Landscape in New Zealand," (2006), Ministry of Research Science and Technology, "New Zealand Biotechnology Strategy," (Government Press, 2003), Ministry of Research Science and Technology, "Roadmaps for Science: Biotechnology Research," (2007), Office of the Prime Minister, "Growing an Innovative New Zealand," ed. Office of the Prime Minister (2002), Royal Commission on Genetic Modification, "Report of the Royal Commission on Genetic Modification," ed. Ministry for the Environment (2002), Statistics New Zealand, "Biotechnology in New Zealand 2005," (2006).

²¹ Royal Commission on Genetic Modification, "Report of the Royal Commission on Genetic Modification."

²² Ministry of Research Science and Technology, "New Zealand Biotechnology Strategy."

²³ Ministry of Research Science and Technology, "Roadmaps for Science: Biotechnology Research."; Organisation for Economic Cooperation and Development, *O.E.C.D. Science, Technology and Industry Scoreboard 2007: Innovation and Performance in the Global Economy*

seeking economic, environmental, social, and knowledge outcomes from its investment in biotechnology research.²⁴ In terms of economic outcomes, the Government is seeking to ensure that biotechnology research contributes directly to increasing the competitiveness of New Zealand industries and sectors and generating new biotechnology firms.

For biotechnology to become a mainstay of economic growth in New Zealand, it is important that:

- biotechnology research is not unduly hampered by lack of access to necessary intellectual property; and
- Government and private investment in biotechnology research is rewarded through protection of the intellectual property created by biotechnology research.

2.3 New Zealand's patent system

A patent is a social contract between the inventor and the State. In return for a grant of exclusive rights to exploit the invention, details of the invention must be made publicly available. Making the details of an invention publicly available means that other inventors can improve upon and 'invent around' the patent, thereby furthering innovation and development in that area.

2.3.1 Patents Act 1953

In New Zealand, the Patents Act 1953 provides the legal structure for the New

(2007). p. 144. See also: Gaia Vince, "New Zealand's Blossoming Biotech Sector," *New Scientist*, no. 2551 (2006).. Total Government spending on biotechnology research for 2006-07 was not available at the time of writing.

²⁴Ministry of Research Science and Technology, "Roadmaps for Science: Biotechnology Research.", p. 30.

Zealand patents system.²⁵ The current New Zealand criterion for the grant of a patent is that the invention must be a “manner of new manufacture”. There is currently no statutory requirement that the invention involve an inventive step, or have a use (though these are legitimate grounds for revoking a patent if later challenged).²⁶

2.3.2 Patents Bill

The Government soon intends to introduce a new Patents Bill to the House (subject to legislative priorities).²⁷ The new Patents Bill makes a number of significant changes to New Zealand’s patents system.

It is likely to introduce more explicit criteria for patentability, specifically:

An invention is patentable if the invention, so far as claimed in a claim,-

(a) is a manner of manufacture within the meaning of section 6 of the Statute of Monopolies; and

(b) when compared with the prior art base as it existed before the priority date of that claim-

i. is novel; and

ii. involves an inventive step; and

(c) is useful; and

(d) is not excluded from being a patentable invention under section 14 or section 15.²⁸

²⁵ The New Zealand Patents Act 1953 is almost identical to the United Kingdom’s Patents Act 1949, which has since been repealed and updated by the Patents Act 1977.

²⁶ Section 41, Patents Act 1953.

²⁷ Warren Hassett, Personal communication by email, 30 November 2007. Since 2008 is an election year, enacting new patents legislation is unlikely to be a priority for the Government, and the new Bill may not be introduced to the House until after the formation of a new Government.

²⁸ Ministry of Economic Development, "Draft Patents Bill," (2004).

The introduction of these criteria ensures that patents will only be granted for inventions that are genuinely new (both in New Zealand and overseas), that involve an inventive step, and are useful.

The current stringency test for the grant of a patent is to give the applicant the “benefit of the doubt”. This means that a patent application will only be refused where IPONZ is practically certain that it would be invalid. Under the proposed new stringency test (clause 69), a patent examiner will need to be satisfied “on the balance of probabilities” that the application meets the criteria for the patent to be granted. This is a higher stringency test and aligns New Zealand’s patent examination stringency test with Australia and the United Kingdom, which have both already updated their equivalent to the New Zealand Patents Act 1953.²⁹

Clauses 86 to 93 of the Patents Bill also provide for more straightforward pre- and post-grant scrutiny and re-examination of patents. Under the current Patents Act 1953, an opposition to the grant of a patent may only be filed to the Commissioner of Patents within three months of the complete specification being accepted and published.³⁰ Once a patent has been granted, the only way of having it narrowed or revoked is to apply to the High Court – often a lengthy, unpredictable and expensive process.

In contrast, clauses 86 and 87 of the Patents Bill allow any person to make an assertion to the Commissioner, prior to the acceptance of a patent, that an invention is not novel or does not involve an inventive step, and the Commissioner is required to take these assertions into account in the examination process. Once a patent has been “accepted” (i.e. examined according to the criteria for patentability and published in the Patents Journal), or

²⁹ United Kingdom Patents Act 1949, now replaced by United Kingdom Patents Act 1977; Australian Patents Act 1952, now replaced by Australian Patents Act 1990. The “balance of probabilities” test was introduced to the Australian Patents Act by the Patents Amendment Act 2001.

³⁰ Accepted patents are published in IPONZ’s Patents Journal, accessible through its website: <http://www.iponz.govt.nz>.

granted any person may request that a patent be re-examined, and the Commissioner must carry out such re-examination (clauses 88 and 89). Clause 90 requires the Commissioner to specifically consider and report on whether the invention is novel and involves an inventive step. Finally, clauses 104 to 107 allow for the Commissioner or the Court to revoke a patent any one of a number of grounds, including on grounds that the invention does not meet the criteria for patentability, it has been insufficiently described, or was granted contrary to law. These provisions are discussed in section 8.1.1 below.

These changes to New Zealand's legislation means that patents of questionable validity and scope are less likely to be granted, and if granted, will be easier to have re-examined. The introduction of a statutory experimental use exemption³¹ provides further clarity to researchers and patent holders as to the boundaries of patent enforceability in a research context. The implications of the experimental use exemption in light of the results of this research are discussed in section 8.1.3.

The strength and effectiveness of granted patents can also have a positive impact on innovation. The changes to the New Zealand patents system augured by the Patents Bill will ensure that patents granted in New Zealand are stronger and more effective by increasing the stringency test and reducing uncertainty surrounding the validity of patents granted once utility is introduced as a criterion and the novelty requirements are tightened. As outlined in Appendix One, some of the legal objections to patents on genetic material centre on the argument that these types of patents do not meet the criteria for patentability – this is even easier to argue in New Zealand where there are fewer criteria than the United States. While the proposed changes cannot affect patents that have already been granted, evidence supports the argument that many patents granted early

³¹ Judith Tizard, "Cabinet Paper: An Experimental Use Exception for New Zealand's Patent Legislation," (2006).

in the genomics revolution are unlikely to withstand legal challenge,³² and are highly unlikely to meet current United States and proposed New Zealand patentability criteria.³³

2.4 *Genetic Technologies Ltd (GTG)*

A full case study on GTG's patents and GTG's enforcement actions in New Zealand is contained in Appendix Five. Just as the rest of the Western world had Myriad enforcing its patents on the susceptibility genes for breast and ovarian cancer (also examined in Appendix Five), New Zealand had GTG. In 2003, GTG approached a number of health and research organisations requesting significant license fees for its patents on methods of analysis of non-coding DNA. After protracted negotiations and the commencement of litigation, all parties reached a settlement which entailed:

- the withdrawal (without payment) of all High Court proceedings between the parties;
- an agreement from both parties not to pursue each other in future in relation to the patents; and
- an agreement to progress the option for GTG to provide laboratory services to ADHB in respect of breast cancer testing.³⁴

As part of the same settlement, GTG granted a commercial licence to AgResearch, HortResearch, Forest Research, and Livestock Improvement

³² Nicol and Nielsen (2003) and Walsh et al (2003) have found that many early, broad patents are not being enforced, likely because they would not withstand legal challenge. As we will see in the GTG case study, GTG also went to some effort to avoid having its patents examined by a court.

³³ The Patents Bill, once enacted, will have the effect of bringing New Zealand's patent legislation in line with its major trading partners, while remaining compliant with New Zealand's obligations under the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs).

³⁴ This part of the agreement appeared to later be the subject of slightly differing interpretations by the two parties. See Denise McNabb, "Health Boards Deny Gene Test Claims," *The Independent* 2005.

Corporation for its foreign patents, for consideration of \$450,000.³⁵ The agreement does not concede the validity of GTG's patents, and nor does it contain a confidentiality clause.

The GTG case spurred policy action in New Zealand on the issue of gene patents. Government action in response to the impacts of patents on genetic material unfortunately occurred without the benefit of systematic research on the extent to which patents were creating issues within the genetics services and research sectors. At the time of GTG's approach, there was very little existing evidence in New Zealand on whether:

- the GTG case was 'the tip of the iceberg' in terms of upcoming gene patents that the genetics services sector may need to take a licence to;
- whether the GTG case was simply a magnified version of what was already occurring within the health sector (i.e. DHBs individually negotiating licences for genetic tests and other laboratory materials); or
- whether GTG's approach to the New Zealand health (and research) sectors was simply a one-off case, whereby GTG was hoping to use New Zealand as a 'test case' to gain national (and thereby international) recognition and validation of its patents.

Despite an initially alarmist response to the potential impacts of patents on genetic material,³⁶ further work by officials led to the conclusion that very few significant structural changes were needed.³⁷ However, policy work on the GTG case is likely to lead directly to the introduction of an experimental use exemption (see section 8.1.3).

³⁵ Ibid.

³⁶ Annette King and Judith Tizard, "Implications of the Granting of Patents over Genetic Material," (2003).

³⁷ Annette King, "Report Back to Cabinet Policy Committee on the Fiscal Risks of the Licensing of Genetic Material Patents in the Health Sector," (released in part under the Official Information Act 1982, 2005), Annette King and Judith Tizard, "Memorandum to Cabinet Policy Committee: Report Back with Recommendations and Options for Addressing Genetic Material Patents," (2004).

The GTG case also led to a unique collaboration between research and health organisations, across both public and private organisations, to examine the patents and attempt to reach a settlement that would be suitable to all parties. The increased bargaining power afforded through the Biosciences Consortium undoubtedly resulted in a better outcome overall than if the parties had each attempted to negotiate individual licenses with GTG. This research therefore investigates whether there have been other instances of such collaborations in the genetics services and biotechnology research sectors, and whether the GTG case has increased their use (or the likelihood of their use) since.

It appears that most organisations approached by GTG were unaware of the existence of their non-coding DNA patents. This research therefore also investigates whether organisations in the genetics services and research sectors in New Zealand are mitigating the existing and potential financial impacts of patents by carrying out proactive patent searches, and whether this searching behaviour has changed subsequent to the GTG case.

2.5 Literature summary

2.5.1 Predominant causes for concern

As noted in section 2.3 above, the patent system is intended to reward innovation by providing exclusive rights to an inventor to exploit his or her invention for a limited time. In return for these rights, the details of the invention are published, thereby furthering potential innovation in the field by encouraging patent holders to 'invent around' a patent. However, concerns have been expressed as to the ability of the patent system to sustain these goals in relation to biotechnology patents, and in particular, gene patents.

Described as the “pro-patent era”,³⁸ the last fifteen years has seen huge growth in the numbers of patent applications granted across all sectors and in all countries, including New Zealand.³⁹ Numbers of biotechnology patents have increased at a faster rate than overall patent filings. The exponential growth in the number of biotechnology patents, and in turn, the sheer numbers of patents on genetic inventions, is the root cause of speculation that these patents may have a chilling effect on research.⁴⁰

In addition to the external and policy incentives that have driven growth in patent numbers,⁴¹ two additional factors have contributed directly to the increased numbers of patents particularly in the area of biotechnology. First, there has been a trend towards the patenting of research tools and upstream biotechnology products, where previously these tools and products may not have been patented (analysed in Appendix One). Secondly, there has been a tendency to ‘fragment’ patent rights across smaller and smaller parts of biotechnology products and processes, resulting in multiple patents over components of a biological product or method.⁴²

Growth in patent numbers

³⁸ See David C. Mowery Jan Fagerberg, Richard R. Nelson, *The Oxford Handbook of Innovation* (Oxford: Oxford University Press, 2005), p. 274 for a discussion on developments in the United States that led to the “pro-patent era” – an era characterised by growth in numbers of patents and a significant strengthening in the value of intellectual property rights, both on national and international levels.

³⁹ Patent applications filed in Europe, Japan and the United States increased by 40% between 1992 and 2002: Organisation for Economic Cooperation and Development, "Patents and Innovation: Trends and Policy Challenges," (2004). Patent applications to IPONZ (from both New Zealand and overseas inventors) have increased 33% in the decade ending 30 June 2006: Intellectual Property Office of New Zealand, "Report of the Commissioner of Patents, Trade Marks and Designs to the Minister of Commerce for the Year Ended 30 June 2006," (2006).

⁴⁰ Two types of patents, gene patents and research tool patents, have been the focus of this concern. Characteristics of these patents are described in Appendix One.

⁴¹ Policy incentives include increased emphasis by governments on capitalising on intellectual property outputs, particularly in the area of biotechnology, and changes to funding of universities, such that they are encouraged to seek intellectual property from, and to commercialise, their research. In the US, the Bayh-Dole Act played an important role in encouraging patenting by universities.

⁴² It has been argued that one cause of this fragmentation is the use of defensive patenting.

Biotechnology patents increased 15% a year at the USPTO and 10.5% a year at the EPO for the years 1990 to 2000, as compared with an annual 5% increase in overall patents.⁴³ This increase is reflected in New Zealand patent grants in the USPTO. Just over ten biotechnology patents were granted to New Zealand inventors in 2000 in the United States, compared with one biotechnology patent in 1990.⁴⁴ More recently, Statistics New Zealand reported that in the two years ending 30 June 2007, New Zealand organisations were granted 225 “biotechnology-related patents”.⁴⁵ It is possible that this includes patents granted both in New Zealand and overseas (so therefore the numbers of patents are double-counted).⁴⁶ It is also possible that the phrase “biotechnology-related patents” is interpreted more widely by survey respondents than the International Patent Classification system classification of biotechnology patents.⁴⁷

It has proven difficult to quantify the resulting subset number of gene patents, as there are different methods of counting these patents, and gene or DNA patents are not specifically categorised under the International Patent Classification system.⁴⁸ The PATGEN Project’s analysis “identified a total of 15,603 patent families claiming human DNA sequences which were published between January 1980 and December 2003”.⁴⁹ Jensen and Murray’s research found that patents

⁴³ Organisation for Economic Cooperation and Development, "Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies."

⁴⁴ *Ibid.*, p. 36.

⁴⁵ Statistics New Zealand, "Biotechnology Survey: 2007," (2008).

⁴⁶ Meighan Ragg, 2008.: "In response to your query, question 56 of the 2007 Biotechnology Survey (patent applications granted), does not exclude patents granted overseas. However, the question asks about patent applications granted to 'this organisation' and the survey is not sent to organisations outside New Zealand. As to whether there is a double counting of patents, there is no specific instruction to only count each patent once (not counted for each country the patent is granted in), therefore, it is possible that double occurs."

⁴⁷ Organisation for Economic Cooperation and Development, "Compendium of Patent Statistics," (2007)., p. 18.

⁴⁸ See Paul Oldham, "Global Status and Trends in Intellectual Property Claims: Genomics, Proteomics and Biotechnology," (United Kingdom: Centre for Economic and Social Aspects of Genomics (CESAGen), 2004)., p. 20-22.

⁴⁹ Michael M. Hopkins et al., "The Patenting of Human DNA: Global Trends in Public and Private Sector Activity," (Brighton, East Sussex: SPRU, Science and Technology Policy Research, University of Sussex, 2006). An earlier analysis carried out by Thomas et al (Sandy M. Thomas, Michael M. Hopkins, and Max Brady, "Shares in the Human Genome - the Future of Patenting DNA," *Nat Biotech* 20, no. 12 (2002).) of the GENESEQ database found that by the end of 2001,

were 'clustered' in particular areas of the genome, with some genes and their various uses and constructs patented up to 20 times.⁵⁰

Despite the international patent application system,⁵¹ it cannot be assumed that a majority of these gene patents have been granted in New Zealand. While numbers of biotechnology granted in New Zealand have certainly increased,⁵² a basic analysis of gene and research tool patents granted in New Zealand (particularly gene and research tool patents) shows that only a small number of those patents identified in overseas research as 'problematic' have been granted in New Zealand (see Appendix One),⁵³ including those which have had aggressive licensing strategies applied to their users in overseas jurisdictions.⁵⁴

It must be noted that the rate of granting of DNA patents has fallen off dramatically in recent years both at the EPO and JPO. In the period 1980-1989, the EPO granted 45% of DNA patent applications, as compared with less than

a total of 18,174 different patent applications had been filed. However, this research has been criticized as not distinguishing between patents that actually claim human DNA and those that are merely disclosed in the patent to enable the invention claimed to be replicated (Mike Stott and Jill Valentine, "Impact of Gene Patenting on R&D and Commerce," *Nat Biotech* 21, no. 7 (2003)). Stott and Valentine also pointed out that not all of the patent families claimed would have been filed in each of Europe, Japan and the United States – meaning that the totals would be different for each country. Finally, they were also concerned that the analysis only identified the numbers of patents that had been filed – and did not specify how many of those had been granted, declined or abandoned. Thomas, in response, argued that while such a large-scale international analysis could only ever be a proxy measure of downstream intellectual rights activity, it was a useful indicator of the original intent of patent applicants: Sandy M. Thomas, "Reply to "Impact of Gene Patenting on R&D and Commerce"," *Nat Biotech* 21, no. 7 (2003).

⁵⁰ Kyle Jensen and Fiona Murray, "Intellectual Property Landscape of the Human Genome," *Science* 310, no. 5746 (2005). Two genes, BMP7 (an osteogenic factor) and CDKN2A (a tumour suppressor gene) were the most highly patented genes in the genome, each having their sequences claimed in 20 patents. Other heavily patented genes included BRCA1 (breast cancer), PIK3R5 (diabetes), and LEPR (obesity).

⁵¹ The Patent Cooperation Treaty (1970) provides for a single filing procedure for all international patent applications filed as such. Each country's intellectual property office carries out an examination of the application.

⁵² Organisation for Economic Cooperation and Development, "Compendium of Patent Statistics," (2006), Organisation for Economic Cooperation and Development, "Compendium of Patent Statistics."

⁵³ This is similar to findings by Nicol and Nielsen who also found that fewer patents had been granted in Australia: Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry."

⁵⁴ Cho et al., "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services."

5% of DNA patents granted in 2001-2003.⁵⁵ To a lesser extent, this has also been the case in the United States. A number of factors have led to this slowing in DNA patent granting. These factors include increasing awareness and general unease, particularly in Europe, surrounding DNA patents; intellectual property offices upskilling in their examination of DNA patent applications; increasing familiarity and dissemination of information within the genetics and biotechnology field (including the publication of the human genome); and the introduction of the *Utility Examination Guidelines* at the USPTO.⁵⁶

Patenting of research tools

Contributing to the growing numbers of patents has been the tendency to patent research tools and upstream products. Essentially, a research tool is any product or raw input that can be used in research.⁵⁷ Foundational research tool patents, such as PCR taq (owned by Roche) and the Cohen-Boyer Patents, have had a huge impact on the pace of biotechnology research. Appendix One outlines the foundational research tool patents that have been patented in New Zealand, as compared with Australia⁵⁸ and the United States.

There is a concern that the patenting of the raw inputs of biotechnology research has the potential to hamper research – particularly where patent owners do not license widely and inexpensively.⁵⁹ While it has been shown that there is

⁵⁵ Hopkins et al., "The Patenting of Human DNA: Global Trends in Public and Private Sector Activity.", p. 17.

⁵⁶ United States Patent and Trademark Office, "Utility Examination Guidelines," (2001).

⁵⁷ See Michelle R. Henry et al., "A Pilot Survey on the Licensing of DNA Inventions," *Journal of Law, Medicine and Ethics* 31, no. 3 (2003), National Institutes of Health, "Report of the N.I.H. Working Group on Research Tools," ed. National Institutes of Health (1998), Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", Thomas, Hopkins, and Brady, "Shares in the Human Genome - the Future of Patenting DNA." for various definitions and interpretations of the term 'research tool'.

⁵⁸ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry."

⁵⁹ Henry et al., "A Pilot Survey on the Licensing of DNA Inventions." Respondents to this research also noted that research tools do not require much development to be useful; do not require patent protection because they are unlikely to become part of a commercial product; are usually licensed non-exclusively; and should not be licensed with reach-through terms.

widespread ownership of research tool patents, particularly among commercial entities,⁶⁰ there is also some evidence that patenting activity in the area of biotechnology has declined due to lower market demand, higher utility requirements on the part of patent offices, and reduced chances of claims extending protection from the raw input to products acting on that raw input.⁶¹

There is also evidence that existing research tools patents are not causing as much of a problem as originally predicted. In the United States at least, it has been found that while there is some degree of 'inventing around' research tool patents, abandoning projects is relatively rare.⁶² Wilful infringement (sometimes in reliance on an experimental use exemption) and/or wilful non-enforcement of patents contributes to this situation, as does comprehensive assessment by research organisations of the intellectual property situation prior to commencing research.⁶³

Fragmentation of patent rights

Finally, a further cause of the growth in patent numbers has been the fragmentation of patent rights across smaller and smaller parts of biotechnology products and processes. In biotechnology, difficulty with such fragmentation can arise where gene fragments are patented but the patents do not identify a corresponding gene, protein, biological function, or potential commercial product.

⁶⁰ Hopkins et al., "The Patenting of Human DNA: Global Trends in Public and Private Sector Activity."

⁶¹ Ibid. This finding is consistent with previous findings by Thomas, Hopkins, and Brady, "Shares in the Human Genome - the Future of Patenting DNA." that research tool patents were the most common utility of DNA patents filed 1996-1999. In the United States public sector, patenting of research tools may have been encouraged to some extent by the Bayh-Dole Act, which essentially allows universities to exclusively license Government-funded inventions to earn income.

⁶² Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", Straus, Holzapfel, and Lindenmeir, *Genetic Inventions and Patent Law: An Empirical Survey of Selected German R&D Institutions*, Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation."

⁶³ Straus, Holzapfel, and Lindenmeir, *Genetic Inventions and Patent Law: An Empirical Survey of Selected German R&D Institutions*, John P. Walsh, Charlene Cho, and Wesley M. Cohen, "View from the Bench: Patents and Material Transfers," *Science* 309, no. 5743 (2005).

Other difficulties with fragmentation can also occur where the same gene fragments are patented but different functions and resulting proteins of those fragments are identified in the patent.

The crowding and fragmentation of patent rights in particular areas has been described as a “patent thicket”, in which those seeking to commercialise new technology must seek licenses from multiple patentees.⁶⁴ Where licenses are not sought or research projects abandoned, it has been argued that this is a “tragedy of the anticommons” – in which a scarce resource (in this case, the genome) is underutilised because the multiple owners each have a right to exclude others from the resource and no one has an effective privilege of use.⁶⁵ Heller and Eisenberg argue that a proliferation of patents across many fragments of a gene or gene product may result in a firm having to go through a number of costly transactions to be able to develop a product (especially where the product uses more than one fragment, as many future products may do).⁶⁶

It can certainly be seen that there is crowding of patent rights in some areas of the genome⁶⁷ (and likely in particular areas of biotechnology more generally). However, available evidence does not show that the fragmentation of intellectual property rights across parts of the genome and more generally in the biotechnology sector has had the flow-on anticommons effect of inhibiting research. However, the fact that there is very little evidence of this crowding impeding research to any great degree is possibly due to the difficulties associated with measuring what research ‘might’ have taken place had the research products been less tied up in intellectual property. Companies do undertake rigorous patent searches to assess the intellectual property in an

⁶⁴ Carl Shapiro, "Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard-Setting," in *Innovation Policy and the Economy*, ed. Adam Jaffe, Joshua Lerner, and Scott Stern (Cambridge, Massachusetts: MIT Press, 2001).

⁶⁵ Heller and Eisenberg, "Can Patents Deter Innovation? The Anticommons in Biomedical Research."

⁶⁶ *Ibid.*

⁶⁷ Jensen and Murray, "Intellectual Property Landscape of the Human Genome."

area,⁶⁸ so research activity is directed into fields where there are less intellectual property constraints.⁶⁹

2.5.2 Impacts of patents on clinical genetic testing services

As discussed and analysed in Appendix One, a number of different types of gene patents have been granted, both in New Zealand and overseas. There are also a number of laboratory and research tool patents, which, if not widely licensed, can have a negative effect on the provision of clinical genetic testing services.

Objections to patents on genetic material range from the fundamental⁷⁰ to the practical. This section analyses in turn the main practical objections to patents on genetic material and genetic tests, and in particular the concerns that these patents may have the following effects on the provision of clinical genetic testing services:

- patents may delay or block the development and offering of diagnostic tests;
- exclusive licensing practices of patent holders may reduce access to genetic testing for patients;
- the licensing fees or royalties charged by patent holders may make tests more expensive to the public health system or privately to patients;
- tests required to be sent to a single provider allow that provider to have a monopoly on the data acquired through testing; and
- direct-to-consumer marketing of genetic tests may change the role of clinicians or have negative outcomes for patients, especially where tests are improperly applied.

⁶⁸ Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation."

⁶⁹ This may be both to avoid existing intellectual property and to enable the company to capitalise on the results of the research through patenting the results of the research.

⁷⁰ These objections are discussed in Appendix One.

In the United States at least, there is some evidence patents have prevented a number of genetic tests from being developed and/or performed by some laboratories.⁷¹ Because a gene patent gives a single firm monopoly power over that gene's use, that firm can dictate the methods used to test for that gene, which can stifle the development and testing of other types of tests for the same gene.⁷² Myriad's patents on the BRCA1/2 genes are a good example of the potential for this to occur.⁷³ However, outside the US there is very little evidence that these patents (and Myriad's aggressive licensing demands) have indeed had the effect of preventing the development and use of other test methods, largely because of opposition to the patents or reluctance to accede to Myriad's licensing demands.⁷⁴ As discussed in 2.1, a number of genetic tests from New Zealand are sent overseas, including to laboratories in the United States. There is therefore the potential for mandated test methods to affect the test methods used by laboratories to which tests are sent.⁷⁵ This issue, and the extent to which patents impact upon tests developed or offered in New Zealand laboratories, is investigated in this research.

⁷¹ Cho et al., "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services.", Jon F. Merz et al., "Diagnostic Testing Fails the Test - the Pitfalls of Patents Are Illustrated by the Case of Haemochromatosis," *Nature* 415, no. 6872 (2002).

⁷² Christina Sevilla et al., "Impact of Gene Patents on the Cost-Effective Delivery of Care: The Case of B.R.C.A.1 Genetic Testing," *International Journal of Technology Assessment in Health Care* 19, no. 2 (2003), p. 296. See KJ Arrow, "The Economic Implication of Learning-by-Doing," *Review of Economic Studies* 50 (1962).; Edwin Mansfield, "Academic Research and Industrial Innovation," *Research Policy* 20 (1991).; Suzanne Scotchmer, "Standing on the Shoulders of Giants: Cumulative Research and Patent Law," *Journal of Economic Perspectives* 5, no. 1 (1991).

⁷³ Sevilla et al., "Impact of Gene Patents on the Cost-Effective Delivery of Care: The Case of B.R.C.A.1 Genetic Testing."

⁷⁴ See Appendix Five for a full case study on the Myriad patents and the US and worldwide reaction to their grant and enforcement.

⁷⁵ Merz et al., "Diagnostic Testing Fails the Test - the Pitfalls of Patents Are Illustrated by the Case of Haemochromatosis." argued that the patent on the haemochromatosis gene had the potential to delay development of genetic tests for other polymorphisms of HFE, or increased the costs of those tests once developed, and increase the likelihood of laboratory errors because of increased sample handling.

Also in the United States, there is anecdotal⁷⁶ and empirical⁷⁷ evidence that the licensing practices engaged in by some patent holders have resulted in limited access to clinical genetic testing services for patients. Licensing practices by patent holders in the early 1990s were clearly lacking in subtlety, with most patentees preferring exclusive licensing⁷⁸ and some employing enforcement tactics involving demanding large up-front payments and per-test royalties.⁷⁹ However, more recent evidence indicates that licensing practices may be more flexible than previously thought, with patent holders (particularly public institutions) only entering exclusive licensing arrangements where the market demand for a patent is limited.⁸⁰ The change in business models and licensing practices over time may have been in response to negative public outcry, but also possibly due to the changing reality of research in the area – which focuses less on commercialising raw materials and more on creating saleable products. The licensing practices of patent holders in the New Zealand genetics services sector is investigated in this research.

There is some evidence that patents may be increasing the cost of genetic testing for the patient or their insurer in the United States.⁸¹ However, this does

⁷⁶ Debra G. B. Leonard, "Gene Patents: A Physician's Perspective," (2004).

⁷⁷ Cho et al., "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services.", Merz et al., "Diagnostic Testing Fails the Test - the Pitfalls of Patents Are Illustrated by the Case of Haemochromatosis.", Anna Schissel, Jon F. Merz, and Mildred K. Cho, "Survey Confirms Fears About Licensing of Genetic Tests," *Nature* 402, no. 6758 (1999).

⁷⁸ Schissel, Merz, and Cho, "Survey Confirms Fears About Licensing of Genetic Tests."

⁷⁹ Leonard, "Gene Patents: A Physician's Perspective.", Merz et al., "Diagnostic Testing Fails the Test - the Pitfalls of Patents Are Illustrated by the Case of Haemochromatosis." The per-test royalties have the potential to be particularly problematic where a number of genetic diseases are prevalent in a particular population. For example, it is recommended that persons of Ashkenazi-Jewish descent undergo carrier screening for cystic fibrosis, Gaucher Disease, Tay-Sachs and Canavan's disease. Each of these tests (excluding Tay-Sachs) has royalties of \$2-12 per test.

⁸⁰ Kirsten Leute, "Patenting and Licensing of University-Based Genetic Inventions - a View from Experience at Stanford University's Office of Technology Transfer," *Community Genetics* 8, no. 4 (2005), Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", Lori Pressman et al., "The Licensing of DNA Patents by Us Academic Institutions: An Empirical Survey," *Nat Biotech* 24, no. 1 (2006). See also Josephine Johnston, "Health Related Academic Technology Transfer: Rethinking Patenting and Licensing Practices," *International Journal of Biotechnology Law* 9, no. 2 (2007).

⁸¹ Cho et al., "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services." In the United States, the cost of genetic tests falls directly to the patient or their insurer.

not seem to be the case in Australia,⁸² although attitudes expressed in the Nicol/Nielsen survey might suggest otherwise.⁸³ To counter these attitudes and to conquer the “fear of the unknown” that appeared to be latent in Australia’s public health sector about gene patents, the Australian Law Reform Commission recommended that the Australian Health Ministers’ Advisory Council establish processes for the examination of the financial impact of gene patents on the delivery of healthcare services in Australia.⁸⁴ The extent to which patents have increased the costs of providing genetic tests in New Zealand’s genetics services sector is investigated in this research.

There is anecdotal evidence that monopoly testing has allowed Myriad to build up a large database of information on BRCA mutations. It is argued that these types of monopolies allow patent holders and/or licensees to:

- *“control details of the variations detected in a given gene, enhancing the monopoly by controlling the means of interpreting test results;*
- *slow the accumulation of information about variations in genes and the relationship of the variations to the disorder in question, by reducing the number of laboratories providing testing; and*
- *restrict rapid publication of information about variations in the gene and their relationship to the disorder in question.”⁸⁵*

Other than the Myriad patents⁸⁶ however, there is little other evidence that such monopoly behaviour is occurring on a more widespread basis.⁸⁷ It also appears

⁸² Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry."

⁸³ A majority of respondents (52%) to Nicol and Nielsen’s survey considered that patents had a negative effect on the cost of tests, consistent with findings to the survey by Cho et al in which 96% of respondents considered that patents had increased the cost of testing to laboratories, and 91% considered it had increased the costs of testing to the patient.

⁸⁴ Australian Law Reform Commission, "Genes and Ingenuity: Gene Patenting and Human Health.", p. 471-472.

⁸⁵ Ibid., p. 501; Institut Curie, "Against Myriad Genetics' Monopoly on Tests for Predisposition to Breast and Ovarian Cancer Associated with the B.R.C.A.1 Gene," *GENET* (2002).

that many of the 'problematic' licensing practices experienced in the late 1990s have ceased (or ceased to be a huge issue), possibly due to public outcry and moves by governments to instigate policy responses to gene patents and monopolistic licensing practices in the medical biotechnology area. While New Zealand has experienced one company utilising these types of licensing practices, there is no other systematic evidence of monopolistic licensing practices occurring in the New Zealand genetics services sector.⁸⁸

Finally, direct-to-consumer (DTC) and direct-to-doctor marketing of genetic tests has been recognised as a potential issue both in New Zealand and overseas.⁸⁹ The main concerns associated with DTC marketing of genetic tests is that home test kits can be misinterpreted, used for improper purposes or without consent, and can give the wrong results if used incorrectly. Psychological harm to patients can also result where home test kits are used and interpreted without trained counselling support. However, so far there is little direct evidence as to the quantum and flow-on effects of DTC provision of genetic testing. In New

⁸⁶ In 2002, Myriad announced that it had published the results of testing 10,000 individuals for the BRCA1/2 mutations (<http://www.myriad.com/news/release/269718>). The study was published in the *Journal of Clinical Oncology*, and identified the specific features of a woman's family history that predict the presence of an inherited mutation in the BRCA1/2 genes. The study showed that mutations were identified in 17% of individuals tested, and the prevalence of these mutations could be linked with the family history of those tested. Myriad undoubtedly had ethical approval, but its monopoly allowed it to build up a databank of this information.

⁸⁷ Athena Diagnostics, exclusive licensee for patents directed to spinocerebellar ataxia, initially demanded that all diagnostic tests for SCA1 be sent to Athena's laboratories in the United States. However, it is not clear that this is still occurring.

⁸⁸ Interestingly, Roche has agreed to fund LabPlus to carry out HER2 genetic testing. HER2 testing determines the genetic variant of the breast cancer and therefore the suggested course of treatment (and eligibility for Herceptin). This means that all women with breast cancer who may need Herceptin must have HER2 testing carried out by LabPlus. LabPlus has a monopoly on this testing in New Zealand, as it is the only laboratory currently funded by Roche: Roche Pharmaceuticals, "News Release: \$100,000 for H.E.R.2 Breast Cancer Testing," (2005).

⁸⁹ American College of Medicine Board of Directors, "A.C.M.G. Statement on Direct-to-Consumer Genetic Testing," *Genetics in Medicine* 6, no. 1 (2004), Mark Henderson, "Handle with Care: Genetic Tests Are Risky, and I've Got Proof," *Times Online*, 1 March 2008, Ruth Hill, "Internet Gene Testing Just 'Health Horoscopes'," (2008), Human Genetics Commission, "The Supply of Genetic Tests Directly to the Public: A Consultation Document," (2002), Johnston, "Costly Genetic Tests for Cancer Worry Specialists.", Andrew Shelling, "Direct-to-Consumer Marketing of Genetic Testing" (paper presented at the NSU Screening Symposium 2008: Get screened and live forever? Wellington, New Zealand, 2008), Bryn Williams-Jones, "Be Ready against Cancer, Now": Direct-to-Consumer Advertising for Genetic Testing," *New Genetics and Society* 25, no. 1 (2006).

Zealand to date there has only been one instance of direct-to-doctor marketing of the BRCA1/2 tests by GTG,⁹⁰ although there are a number of Australian and other overseas companies offering genetic test kits for sale direct over the internet.⁹¹ The issues relating to DTC provision of genetic tests over the internet warrant further serious consideration, particularly in publicly-funded healthcare systems where increased patient demand for both testing and counselling services can have major implications for the public health purse.

This section has briefly examined existing evidence on the impacts of patents on the provision of clinical genetic testing services, including evidence on whether patents delay the development and use of tests; whether the licensing practices of patentees reduce access to particular tests; whether patents increase the costs of tests; the potential for patents to allow a monopoly on particular data; and the issues surrounding DTC provision of genetic testing. There is some evidence that gene patents and their related licensing practices have caused some laboratories in the US to not develop or offer particular tests. However, this was not found to have been the case in Australia. In addition, most anecdotal evidence focuses on the actions of Myriad Genetics Inc, in enforcing its patents on BRCA1 and BRCA2.⁹² Caulfield et al found in a survey of policy reports that Myriad Genetics' actions were used as a primary tool to justify patent reform, rather than relying on systematic evidence of an existing problem.⁹³ The same criticism could be fairly leveled at the New Zealand Government in their response to the GTG controversy.⁹⁴

⁹⁰ Johnston, "Costly Genetic Tests for Cancer Worry Specialists."

⁹¹ See, for example: <http://www.decode.me.com> and an article on its use: Henderson, "Handle with Care: Genetic Tests Are Risky, and I've Got Proof."; <http://www.23andme.com/>; <http://www.easydna.co.nz/>; <http://www.dnanow.com/>; <http://www.securigene.com/>; <http://www.gtg.com.au/HumanDNATesting/index.asp?menuid=070>; <http://www.analysisofhair.com/Alzheimer'stest/index.html>.

⁹² See Appendix Five.

⁹³ Caulfield et al., "Evidence and Anecdotes: An Analysis of Human Gene Patenting Controversies."

⁹⁴

Appendix Five.

See

2.5.3 Impacts of patents on biotechnology research

There has been a large degree of speculation and discussion on the impacts of patents, and particularly gene and research tool patents, on biotechnology research.⁹⁵ There is no doubt that there has been exponential growth in patents in the biotechnology area, possibly partly due to a rise in 'defensive' patenting⁹⁶ and fragmentation of patent rights across increasingly smaller parts of biotechnology products and processes. Patents themselves have also become increasingly complex as the science advances. My analysis of common research tool patents (Appendix One) suggests that many of these research tools have not

⁹⁵ Steve Bunk, "Researchers Feel Threatened by Disease Gene Patents," *The Scientist* 13, no. 20 (1999), Sara Dastgheib-Vinarov, "A Higher Nonobviousness Standard for Gene Patents: Protecting Biomedical Research from the Big Chill," *Marquette Intellectual Property Law Review* 4 (2000), Dutfield, "DNA Patenting: Implications for Public Health Research.", Rebecca S. Eisenberg et al., "Intellectual Property Rights and Research Tools in Molecular Biology" (paper presented at the Workshop held at the National Academy of Sciences, 15-16 February 1996, Washington DC, 1996), Alison Heath, "Preparing for the Genetic Revolution - the Effect of Gene Patents on Healthcare and Research and the Need for Reform," *Canterbury Law Review* 11 (2005), Heller and Eisenberg, "Can Patents Deter Innovation? The Anticommons in Biomedical Research.", Johnston, "Health Related Academic Technology Transfer: Rethinking Patenting and Licensing Practices.", Josephine Johnston and Angela A. Wasunna, "Patents, Biomedical Research and Treatments: Examining Concerns, Canvassing Solutions," *Hastings Centre Report* 37, no. 1 (2007), National Institutes of Health, "Best Practices for the Licensing of Genomic Inventions," *Federal Register* 69, no. 223 (2005), National Institutes of Health, "Report of the N.I.H. Working Group on Research Tools.", Organisation for Economic Cooperation and Development, "Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies.", Scotchmer, "Standing on the Shoulders of Giants: Cumulative Research and Patent Law.", Stott and Valentine, "Impact of Gene Patenting on R&D and Commerce.", The Royal Society, "Keeping Science Open: The Effects of Intellectual Property Policy on the Conduct of Science," in *Royal Society reports* (The Royal Society, 2003), Thomas, "Reply to "Impact of Gene Patenting on R&D and Commerce".", Nikolaus Thumm, "Patents for Genetic Inventions: A Tool to Promote Technological Advance or a Limitation for Upstream Inventions?" *Technovation* 25, no. 12 (2005), Nikolaus Thumm, *Research and Patenting in Biotechnology: A Survey in Switzerland* (Bern: Swiss Federal Institute of Intellectual Property, 2003), Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation.", A. R. Williamson, "Gene Patents: Socially Acceptable Monopolies or an Unnecessary Hindrance to Research?" *Trends in Genetics* 17, no. 11 (2001).

⁹⁶ 'Defensive' or 'strategic' patenting is commonly employed by companies in the biotechnology and software industries. Defensive patenting involves patenting an invention, all components of an invention, and any other useful intellectual property one might have produced along the way. In this manner, companies are able to 'ringfence' and protect their inventions and intellectual property, thus protecting their areas of research. The creation of large patent portfolios also served to ward off potential litigants. As Chris Pratley, a Microsoft employee described, "So if a big company tried to sue us, we could find something in our portfolio they were afool of, and counter-sue. In the cold war days, this strategy was called "mutual assured destruction", and since it was intolerable for all parties to engage, it resulted in a state called "détente", or "standoff".": Chris Pratley, "Defensive Patenting," (2004).

been patented in New Zealand, and it is possible that this is also the case for other biotechnology patents. In addition to the above factors, particular types of patents and licensing practices have caused some concern in the biotechnology industry. These are examined in turn below and include:

- broad or blocking patents;
- restrictive or exclusive licensing practices;
- royalty stacking;
- reach-through claims;
- general uncertainty caused by numbers of patents and increasing complexity of patent claims;
- breakdowns or delays in negotiations; and
- delays in publication.

Broad or blocking patents are those patents that grant broad rights to a patent holder, which may be seen as covering applications later invented by someone else.⁹⁷ Broad patents, unless they are widely licensed (or not enforced), can discourage research and innovation because researchers may be reluctant to carry out research which they consider breaches the patent, or unwilling to pay license fees for the use of the patent.⁹⁸ Many broad patents were granted early

⁹⁷ In some US case law, a 'blocking patent' refers to an improvement patent, where a patent improves on an original invention but blocks use of the original invention because the improvement patent allows the improver to deny the original patent-holder unfettered use of his/her broadest claim. The improvement patent, on the other hand, is 'dominated' by the original patent, and the improver cannot use his own invention without the consent of the original patent holder. In such cases, a cross-license may be used. See *Bayer V Schein Pharm. Inc.*, 301 F.3d 1306 (2002), 1325; discussed in Andrew J Caruso, "The Experimental Use Exception: An Experimentalist's View," *Albany Law Journal of Science & Technology* 14 (2003-2004), p. 234-237. 'Blocking patents' in this context is used to describe patents that cover applications invented by someone else, whether the applications were invented before or after the blocking patent. This definition thus encompasses the narrower term used in US legal parlance. The term 'blocking patent' can also be used to describe a patent that contains 'reach-through' claims – where the patent claims an invention, but also claims all substances that might result from that invention.

⁹⁸ The GTG patents on junk DNA (Malcolm Simons, "Genomic Mapping Method by Direct Haplotyping Using Intron Sequence Analysis Variations," (1991), Malcolm Simons, "Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes," (1991).) are a good example of patents whose broad claims (and the broad claims of the

in the genomics revolution, and some of these broad patents have had aggressive licensing strategies applied to their use.⁹⁹ However, these patents are now less common since the introduction of the USPTO's *Utility Examination Guidelines*.¹⁰⁰ In addition, evidence suggests that researchers are either ignoring broad patents or have found ways of gaining access to or working around necessary intellectual property. Despite this, it is clear that a small number of research projects are abandoned or not commenced due to the existence of particular patents.¹⁰¹ However, this does not appear to be the norm and is likely to become less common as older patents lapse and new broad patents are not granted as often. In addition, many companies rely heavily on assessing the existing intellectual property in a field of research before progressing a project.¹⁰² Given New Zealand's experience with the GTG patents, this research investigates whether there are other instances of broad patents that are creating difficulties in the biotechnology sector.

It is the prerogative of a patent-holder to enter into exclusive licence arrangements – such is the nature of the patent system itself. However, the exclusive or restrictive licensing practises of some patent owners have fuelled concerns that particular patents (and their related licensing) may have a negative

assignees) have resulted in considerable uncertainty for researchers and clinicians. The CCR5 patent is also a good example of both a broad and a blocking patent. In February 2000, Human Genome Sciences Inc (HGS) was awarded a patent which claimed rights over the gene that codes for the CCR5 receptor (New Zealand patent 527126). HGS claimed in its patent that the CCR5 protein product was a cell-surface receptor, including a receptor for viruses. HGS intended to exploit the patent primarily for the development of anti-inflammatory therapies, but the utility claims are fairly broadly drafted, covering many uses for a variety of illnesses. Six months after HGS filed its patent application in the United States, the role of the CCR5 receptor as the route by which HIV/AIDS enters a cell was discovered. Even though CCR5's role as the receptor for HIV/AIDS was not claimed by HGS as a utility in its patent (or even suspected by HGS as a possible role of CCR5), HGS has since been licensing pharmaceutical companies for the use of the CCR5 receptor gene in research into new HIV/AIDS drugs, and also appears to be carrying out its own research with a view to developing a treatment for HIV/AIDS: Human Genome Sciences Inc, "Annual Report 2005," (Human Genome Sciences Inc, 2005).

⁹⁹ See, for example, Leonard, "Gene Patents: A Physician's Perspective."

¹⁰⁰ United States Patent and Trademark Office, "Utility Examination Guidelines."

¹⁰¹ Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation.", p. 325. Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 143-144.

¹⁰² Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 140-141.

effect on innovation and research.¹⁰³ Exclusive licensing behaviour can create difficulties for others in the industry, particularly where the patent covers research inputs or “targets”,¹⁰⁴ or overly aggressive licensing tactics are employed.¹⁰⁵ At this stage however, other than anecdotal evidence from a few large US companies,¹⁰⁶ recent evidence¹⁰⁷ shows that exclusive licenses are used only where necessary,¹⁰⁸ licenses are relatively easily sought and granted when needed,¹⁰⁹ and exclusive licensing is having little effect on academic research.¹¹⁰ The licensing practices encountered by New Zealand biotechnology research organisations are investigated in this research.

¹⁰³ See Nuffield Council on Bioethics, "The Ethics of Patenting DNA: A Discussion Paper." at pp. 56-61 or Organisation for Economic Cooperation and Development, "Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies.", pp. 12-14.

¹⁰⁴ The word 'target' can refer to any cell receptor, enzyme or protein implicated in a disease, therefore presenting a promising locus for drug intervention (and an important class of research tool). A large pharmaceutical company might have a library of compounds that affect a target, but these compounds are either patented or kept secret, and the chances of finding a compound that affect the target are less when the target is exclusively licensed. Such problems are exacerbated when ownership of a set of targets is in the hands of smaller firm with limited capabilities: Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation.", p. 311.

¹⁰⁵ *Ibid.*, pp. 312-313.

¹⁰⁶ Evidence of the effects of the exclusive or restricted licensing of targets is limited to a few 'big' examples – Myriad Inc and the BRCA patents, Chiron and its patents on the hepatitis C virus protease, and Geron's patents on telomerase – though it is arguably very difficult to measure the cumulative effect of the small targets that are exclusively licensed, or not licensed at all.

¹⁰⁷ Research from the late 1990s suggested that exclusive licensing was the most common type of licensing: Schissel, Merz, and Cho, "Survey Confirms Fears About Licensing of Genetic Tests.", though later research in 2001 showed that a wide variety of licensing practices were employed by patent holders, with patent seeking behaviour and license type able to be correlated to the profit/non-profit status of the organisation.

¹⁰⁸ Henry et al., "A Pilot Survey on the Licensing of DNA Inventions.". Henry et al speculate that differences in licensing practices may result from a preference by non-profits for exclusive licensing in order to maximise the short-term profits and minimise license management costs; and the requirement under the Bayh-Dole Act for non-profits to give licensing preference to small firms (who might insist on exclusivity to preserve a market advantage): Michelle R. Henry et al., "DNA Patenting and Licensing," *Science* 297 (2002). These speculations are borne out by evidence from the Association of University Technology Managers, which confirms that a large proportion of university discoveries are exclusively licensed: Association of University Technology Managers, *F.Y.2005: A.U.T.M. U.S. Licensing Survey* (2007).

¹⁰⁹ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", pp.146-151. Nicol and Nielsen found that exclusive licensing is common in the biotechnology industry, however, refusals to license were not a pervasive issue.

¹¹⁰ Walsh, Cho, and Cohen, "View from the Bench: Patents and Material Transfers."

“Royalty stacking”¹¹¹ and “reach-through terms”¹¹² are commonly encountered in the biotechnology sector,¹¹³ but neither factor generally causes project collapse. It is likely that extensive patent searching and assessment ensures that organisations only venture into research territory that is relatively unencumbered, or where it is known that licenses can be negotiated. These searches represent one aspect of the transaction costs¹¹⁴ associated with assessing and gaining access to intellectual property. The transaction costs associated with searching for, assessing, and gaining access to necessary intellectual property appear to be an area of difficulty for many companies in the biotechnology sector.¹¹⁵ What is most important here is whether these costs – likely to be a necessary adjunct to doing business in the industry – are overly high or crippling in some circumstances. Available evidence suggests that while the costs are considerable, they are well-managed – in the US and Australian biotechnology industries at least. The evidence also suggests that patent searches do have a strong relationship to research projects undertaken by a company. Some may argue that this can result in valuable research being abandoned or not undertaken (as might have happened in the CCR5 example).¹¹⁶ However, this arguably results in research being directed to areas that are less encumbered

¹¹¹ “Royalty stacking” is a term characterising a situation in which multiple license agreements must be negotiated in order for a company to enter a particular field or to commercialise a product, resulting in royalties being paid to multiple patent holders.

¹¹² “Reach-through terms” are usually part of a license agreement, and give a patent holder rights on the ‘downstream’ products created using their research tool or invention. Such rights might include royalties from future sales, and exclusive or non-exclusive rights or options to license future discoveries.

¹¹³ Nicol and Nielsen, “Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.”, Straus, Holzapfel, and Lindenmeir, *Genetic Inventions and Patent Law: An Empirical Survey of Selected German R&D Institutions*, Thumm, *Research and Patenting in Biotechnology: A Survey in Switzerland*, Walsh, Cho, and Cohen, “View from the Bench: Patents and Material Transfers.”

¹¹⁴ These costs include: monitoring for patents held by other firms that might affect current research, as well as the costs to patent-holders of enforcing their own intellectual property; delays associated with putting a research program on hold while access to intellectual property is negotiated; the direct costs of negotiation or litigation; and costs associated with invention around patents, or redirecting or relocating research to avoid intellectual property issues.

¹¹⁵ Henry et al., “A Pilot Survey on the Licensing of DNA Inventions.”, Nicol and Nielsen, “Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.”, Walsh, Arora, and Cohen, “Effects of Research Tool Patents and Licensing on Biomedical Innovation.”

¹¹⁶ Eliot Marshall, “Gene Patents: Patent on H.I.V. Receptor Provokes an Outcry,” *Science* 287, no. 5457 (2000).

and in which research dollars will be well spent. This research will therefore investigate the transaction and licensing costs faced by the New Zealand biotechnology industry, and the burden these costs place on organisations in the industry.

Finally, there is some evidence that the desire to patent does delay publication of research results, particularly in the area of genetics. For an invention to be patentable, it must be novel, meaning that details of the invention must not be disclosed prior to the submission of the patent application.¹¹⁷ Because of the incentives now placed on universities to gain commercial advantage from their research, there is some evidence that publication of research may be delayed due to a desire to patent.¹¹⁸ There is also some evidence that research and material sharing between academic researchers is delayed or withheld altogether,¹¹⁹ possibly due to incentives to commercialise and increased competition between researchers. This practice is in opposition to the dogma of openness and communalism in modern science. However, it may simply reflect changing norms and a modification of the relationship between universities and the private sector.

This section has analysed current evidence on the impacts of patents on the biotechnology research sector, including evidence on:

¹¹⁷ Different countries take different approaches to the requirements for novelty. In most, publication of the invention (anywhere in the world) prior to the submission of a patent application will defeat a patent's novelty. In the United States, an inventor has one year from the disclosure of his/her invention to file a patent application, otherwise novelty is lost (so publication can sometimes occur prior to a patent application): United States Patent and Trademark Office, "General Information Concerning Patents," (2005). In New Zealand, an invention must not be disclosed, subject to some exceptions for disclosure in confidential or other exceptional circumstances, or for display of the invention at a trade fair within the six months prior to filing: Intellectual Property Office of New Zealand, "Introduction to Patents," (Ministry of Economic Development, 2005).

¹¹⁸ D. Blumenthal et al., "Withholding Research Results in Academic Life Science. Evidence from a National Survey of Faculty," *Journal of the American Medical Association* 277, no. 15 (1997).; Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", pp. 127-128.

¹¹⁹ Eric G. Campbell et al., "Data Withholding in Academic Genetics," *Journal of the American Medical Association* 287, no. 4 (2002).; Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation.", p. 321.

- the impacts of particular types of patents, including broad or blocking patents and research tool patents;
- the impacts of particular types of licensing practices or behaviours, including restrictive or exclusive licensing, royalty stacking, and reach-through clauses;
- the transaction costs associated with searching for, assessing and negotiating access to necessary intellectual property; and
- the impact of patents on data and materials sharing and on publication timing.

In all of the above areas there is evidence that patents have the potential to cause difficulties for researchers. However, biotechnology organisations appear to have adapted to the complex patent landscape and have developed new ways of working to overcome the difficulties they face. In addition, the companies often cited as “outliers” in the biotechnology industry (e.g. Myriad, GTG etc) have modified their business practices and are no longer as aggressive in enforcing their patents. Other companies may also have seen the fallout from the types of licensing behaviour employed by these companies, and also changed their business practices accordingly. Notwithstanding, one might expect that issues faced by companies overseas would also be faced by New Zealand companies, and possibly would have a larger impact due to the small size and resources of the New Zealand biotechnology industry. It was therefore deemed important to investigate whether these issues are faced by the New Zealand biotechnology sector, and the impact of patents in this sector.

2.5.4 Impacts of patents on innovation

Many developments in the area of clinical genetic testing and biotechnology may not have been made, or at least not as quickly, without the incentive provided by patent protection. It is important to recognise the benefits that patent protection

may have brought to developments in this area. It would seem that in the pharmaceutical industry at least,¹²⁰ and by extrapolation, the biotechnology sector, patents provide a much stronger incentive to innovate than other sectors.¹²¹ In addition, the specific structure of the patent system, including the strength of patents granted, ease of challenge, and the certainty of specific exemptions play an important role in ensuring certainty and encouraging innovation and investment in general (as with any strong property rights system). Primary research on the incentive effects of patents falls squarely into the discipline of economics, and is therefore outside the scope of this research. However, the role of the legal structure of the patent system in encouraging innovation is briefly discussed in this section.

Lévêque and Ménière note that strength and effectiveness of patent protection can have a positive impact on innovation, though only up to a certain point. The strength of patents is determined by the duration of the patent and the scope of patent claims. The maximum duration of patents is usually 20 years, but can be less than this depending on whether the patentee pays renewal fees to ensure the patent remains in force for the entire 20 years. The duration of patents can thus be increased by lowering the renewal fees, which may have some bearing on an inventor's willingness to innovate and patent in the first instance.¹²²

¹²⁰ Wesley J. Cohen, Richard R. Nelson, and John P. Walsh, "Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)," (Carnegie-Mellon University, 2000), Richard Levin et al., "Appropriating the Returns from Industrial Research and Development," *Brookings Papers on Economic Activity: Microeconomics* (1987), Edwin Mansfield, "Patents and Innovation: An Empirical Study," *Management Science* 32, no. 2 (1986), Frederick M Scherer, "The Economics of Human Gene Patents," *Academic Medicine* 77, no. 12 (2002).

¹²¹ Ashish Arora, Marco Ceccagnoli, and Wesley M. Cohen, "R&D and the Patent Premium," (NBER Working Paper No. W9431, January 2003). According to Arora et al's findings, the average additional benefit to be gained from patenting an invention in the area of biotechnology (the "patent premium") is positive in biotechnology, whereas it is negative for all other sectors. It is therefore generally profitable to patent an invention in biotechnology. If the patent premium was to increase by 10% in biotechnology, firms would respond by increasing their R&D investment by 10.6%, which is greater than the 6% average increase in all sectors.

¹²² François Lévêque and Yann Ménière, "Patents and Innovation: Friends or Foes?" in *Law and Technology Scholarship*, ed. Berkeley Center for Law and Technology (Berkeley: eScholarship Repository, University of California, 2007).

The impact of patents on incentives to innovate also depends upon patent effectiveness, including factors such as the cost and delay associated with obtaining and enforcing patent protection and the degree of certainty about the expected outcomes of patent litigation.¹²³

In New Zealand, patent application and renewal fees are relatively low: NZ\$281.25 to lodge a complete patent application and renewal fees ranging from \$191.25 (4th year renewal) to \$1125 (13th year renewal).¹²⁴ By the thirteenth year, a patent holder would have a reasonably good idea of whether renewing the patent was commercially prudent. However, the total upfront application costs for one patent (mostly made up of solicitor's fees) is around \$20,000-\$30,000,¹²⁵ and this can be prohibitive for some organisations.

An inventor's decision to enforce their patents through litigation often depends largely on the costs and benefits of litigation. As can be seen above, provided a company can afford the initial outlay to gain a patent (\$20,000-\$30,000), the costs of patent renewals are relatively low – the main obstacle to patent enforcement (other than transaction costs) is the cost of litigation. Perhaps as a response to the financial challenges posed by patent enforcement, the insurance industry has begun to offer patent insurance, which, depending on the premium, can protect a company from being pursued (Patent Liability Insurance) or can assist a company to enforce a patent (Patent Pursuance Insurance). GTG made no secret of the fact that it held patent insurance, but throughout the negotiations with the Biosciences Consortium it was not clear exactly what the insurance would cover. Whether the insurance was used as a litigation “bluff” or whether it existed to the extent necessary to cover GTG in case of revocation proceedings,

¹²³ Ibid.

¹²⁴ See http://www.iponz.govt.nz/iponz-docs/P/patent_fees_V4.pdf, accessed 15 November 2007.

¹²⁵ Interview participant from a technology transfer office.

GTG's statement that it had patent insurance was a factor in the Government's decision to settle with GTG.¹²⁶

The scope of a patent's claims is usually determined through judicial determination of the construction of a patent's claims.¹²⁷ However, even at the examination stage, the standard to which the patent is being examined (the stringency test) will have a bearing on the scope of claims and overall validity of the patent. In New Zealand at present, a patent application can only be declined when it is "practically certain" that the patent would be held to be invalid.¹²⁸ The stringency test therefore gives patent applicants the "benefit of the doubt" even where the patent may be held to be invalid upon challenge. Under the new Patents Bill, the stringency test is likely to change to a "balance of probabilities", where a patent will only be granted if, on the balance of probabilities, the requirements for patentability have been met. This will ensure patents are stronger upon grant.

The existence of various limitations on the exploitation of a patent (e.g. compulsory licensing, an experimental use exemption) can also impact on patent strength.¹²⁹ The introduction of a statutory experimental use exemption in New Zealand, while only intended to clarify the existing common law exemption, may therefore have some bearing on the perceived strength of patents in New Zealand. However, this will likely be offset by the improved strength of patents upon grant, through the introduction of expanded criteria for patentability and a more rigorous examination test.

¹²⁶ Ministry of Health, "Genetic Technologies Limited (G.T.G.) Patent Infringement Claim," (released in part under the Official Information Act 1982, 2003), Ministry of Health, "Genetic Technologies Ltd (G.T.G.) Patents - Update on Proposed Litigation," (released in part under the Official Information Act 1982, 2004).

¹²⁷ Lévêque and Ménière, "Patents and Innovation: Friends or Foes?"

¹²⁸ New Zealand courts followed United Kingdom precedents in applying this test, reasoning that patent examiners would not have the benefit of the arguments of counsel and oral evidence. Judith Tizard, "Review of the Patents Act 1953 Stage 3: Part 1," (2003).

¹²⁹ Lévêque and Ménière, "Patents and Innovation: Friends or Foes?"

As can be seen above, the current stringency test and patentability criteria mean that some patents granted in New Zealand may not be as strong as possible, or may be broader in scope than justified. In addition, it is relatively difficult at present to challenge a patent, as this must be done by way of revocation proceedings in the High Court. The Patents Bill contains administrative procedures which allow for re-examination of patents by the Commissioner of Patents (either on his or her own initiation or at the request of another person).¹³⁰

Therefore, in New Zealand at present, patents that are granted may be argued to be less strong than is ideal, but the difficulty in challenging these patents posed by the costs of litigation increases this patent strength somewhat. The introduction of an increased stringency test will retain a similar balance, albeit by different means – patents of questionable validity will be unlikely to be granted and procedures which make it easier to have patents re-examined (without litigation) will mean that patents of questionable validity or scope can be more easily challenged. Ensuring that patents are strong from the outset (i.e. upon grant) is preferable to balancing their strength by making it difficult to challenge a patent. The reforms proposed for the New Zealand patent's system will ensure that innovation continues to be fostered by the patent system.

2.6 Implications for this research and research questions

New Zealand-specific evidence on the impacts of patents in the genetics services and biotechnology sectors is fragmented at best, and mostly non-existent. Anecdotal evidence on the impact of patents in the genetics sector was collected by the Ministry of Health during the GTG case (see

¹³⁰ Ministry of Economic Development, "Draft Patents Bill.", clauses 88-93.

Appendix Five), and some information on intellectual property issues is collected in Statistics New Zealand's Biotechnology Survey.¹³¹ Some other information on the impacts of intellectual property in the biotechnology and genetics services sectors can be gleaned from scanning a variety of sources (designed primarily to address other issues).¹³²

This current context presents a unique set of circumstances in which to carry out research on the impacts of patents in New Zealand's biotechnology and genetics services sector. Having recently dealt with the GTG case, an investigation into the impacts of patents in these sectors is warranted. Should this research indicate that structural changes are needed to address the impact of patents in these sectors, this could be achieved through a submission on the Patents Bill when it is considered at Select Committee.

The literature discussed above and the context therefore indicates that any investigation into the impacts of patents in the genetics services and research sectors in New Zealand should seek to:

- collect information directly from sector participants – researchers and clinicians in particular;
- acknowledge and analyse New Zealand's previous experience with these issues through the GTG case; and

¹³¹ Statistics New Zealand, "Biotechnology in New Zealand 2005.", Statistics New Zealand, "Biotechnology Survey: 2007."

¹³² For example, the annual reports of CRIs and companies report on numbers of patents granted, FRST reports on intellectual property arising out of FRST-funded research projects (as do other government funding agencies), and occasional research has previously been undertaken by Government departments and private researchers: Science and Technology Foundation for Research, "Protecting and Managing Intellectual Property: Patenting Decisions of Publicly Funded Research Providers," (2004), LEK Consulting, "New Zealand Biotechnology Industry Growth Report," ed. Ministry of Research Science and Technology, New Zealand Trade and Enterprise, and NZBio (LEK, 2006), Morgan et al., "Genetic Testing in New Zealand: The Role of the General Practitioner.", Sarfati, "Some Practical Aspects of Genetic Testing in New Zealand: A Report for the National Health Committee.", Scott and Plessis, "Redefining a Technology: Public and Private Genetic Testing in New Zealand", Shelling, "Direct-to-Consumer Marketing of Genetic Testing", Statistics New Zealand, "Biotechnology Survey: 2007.", World Health Organisation Genomic Resource Centre, "Case Study: New Zealand," (World Health Organisation).

- take account of the impact of existing and future legislation and Government policy in this area.

This research therefore aims to collect, in a single place, information on the positive and negative impacts of patents on the genetics services and research sectors in New Zealand, and in particular investigates:

- the extent to which genetic services and research organisations in New Zealand are affected by the increasing complexity of the patent landscape;
- whether New Zealand genetic services and research organisations are affected by the particular patents and licensing practices that have been identified as ‘problematic’ overseas; and
- the patenting and licensing practices of New Zealand biotechnology organisations.

The particular issues faced by New Zealand’s genetic services sector investigated in this research include:

- the extent of patent searching;
- whether patents delay the development and use of genetic tests;
- whether the licensing practices of patentees reduce access to particular tests and the extent of licensing in;
- whether patents increase the costs of tests to laboratories;
- instances of coordination between genetics services to obtain licenses; and
- clinicians’ attitudes on the impacts of patents, and particularly gene patents, on genetic testing.

While DTC marketing and provision of genetic tests is an important issue, it was deemed to be outside the scope of this research. The expansion of private, web-based testing should be monitored and investigated in future.

The particular issues faced by the New Zealand biotechnology research sector investigated in this research include:

- the extent of patent searching and assessment and the transaction costs associated with these activities;
- the extent of licensing in and difficulties obtaining access to necessary intellectual property;
- instances of coordination between organisations to obtain licenses;
- the extent of patent ownership and licensing out; and
- attitudes of researchers on the impacts of patents in their field.

Much of the previous research in this area has sought the views of those providing services to the genetics services and biotechnology sectors. The views of consultants, patent attorneys, and technology transfer officers, among others, were sought on the impacts of patents in the genetics services and research sectors.

While the the incentive effects of patents on innovation will not be specifically investigated in this research, it is important for any results arising relating to this topic to be acknowledged and reported on.

3 Methodology

3.1 Introduction

The discipline of law does not have a strong tradition of the use of formal empirical analysis to investigate the impact of particular legal structures and mechanisms on those who are using them. Legal discourse commonly involves the examination and critique of particular statutes and case law, and discussion on their application to modern or emerging issues through the use of existing evidence. There is very little existing data on the impacts of patents in New Zealand's genetics services and research sectors, though relatively recent research has touched on patents as emerging issues in both sectors.¹³³ This research therefore uses a survey and informal follow-up interviews to provide context and some evidence base for a discussion on New Zealand's current and proposed patent law. The methodology of this research is therefore qualitative, and is useful for examining common trends and themes emerging within the New Zealand biotechnology and genetics services sectors. The methodology and survey structure are based largely on the methodology used by Nicol and Nielsen in their research on this issue with medical biotechnology organisations in Australia,¹³⁴ thus enabling a comparison of sorts with the Australian medical biotechnology industry, and with research carried out in the United States.¹³⁵

¹³³ LEK Consulting, "New Zealand Biotechnology Industry Growth Report.", National Advisory Committee on Health and Disability, "Molecular Genetic Testing in New Zealand.", Royal Commission on Genetic Modification, "Report of the Royal Commission on Genetic Modification.", Sarfati, "Some Practical Aspects of Genetic Testing in New Zealand: A Report for the National Health Committee.", Scott and Plessis, "Redefining a Technology: Public and Private Genetic Testing in New Zealand", Statistics New Zealand, "Biotechnology in New Zealand 2005."

¹³⁴ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry." However, it must be said that Nicol and Nielsen's research was able to take a more quantitative approach due to sector size and increased participation.

¹³⁵ In particular, Cho et al., "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services.", Merz et al., "Diagnostic Testing Fails the Test - the Pitfalls of Patents Are Illustrated by the Case of Haemochromatosis.", Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation."

3.2 Ethical approval

In accordance with the University of Otago 'Policy on Ethical Practices in Research and Teaching Involving Humans',¹³⁶ the research proposal and methods (involving the survey and follow-up interviews) were approved at a Departmental level in accordance with the Policy. The proposal is attached as Appendix Four.

3.3 Database construction

The first part of this research involved constructing a database containing details of clinical genetic testing services and organisations carrying out research or providing services to those sectors in New Zealand.

As discussed in section 2.1, genetics services are provided through two regions of authority, the Northern Regional Genetics Service and the Central and Southern Regional Genetics Service. These services have providers based in Auckland, Wellington, and Christchurch, and there is a clinical geneticist based in Dunedin. There are a few other providers of clinical genetic testing services, usually in particular areas of research. The Human Genetics Society of Australasia has a list on their website¹³⁷ of all providers of clinical genetic testing services in Australia and New Zealand. All providers on the list for New Zealand were included in the list to be surveyed. The contact details for the New Zealand providers were checked for accuracy (using the internet and other relevant resources). Internet searches were carried out to ensure that there were no other providers, and the list of providers was peer reviewed by a clinical geneticist.

¹³⁶ <http://www.otago.ac.nz/acadcomm/policyethicalpractices.html>, last accessed 22 December 2007.

¹³⁷ Human Genetics Society of Australasia, "DNA Diagnosis of Genetic Disorders in Australasia."

The Ministry of Research, Science and Technology provided, upon request, a general list of all organisations participating in the biotechnology industry in New Zealand. This list was organised according to company name, sector (e.g. marine, plant-based biotechnologies, innovative foods and human nutrition, biomedical etc), classification (e.g. association, legal, core biotech, research institution, government etc), and was able to be sorted within each category.

From this list I selected all organisations that were classified as 'Core Biotech'. This group included all companies carrying out research in New Zealand, whether plant or animal research, or biomedical science and drug discovery. I also selected organisations classified as 'Legal', 'Research Institute', 'Services', 'Supply', and 'Consultant', as these were deemed to be relevant to the survey. Service suppliers to the biotechnology industry were included for their ability to provide a broad perspective of what may be occurring in the sector.

The list was then checked against the membership list of NZBio (the industry organisation for the biotechnology sector in New Zealand) for any relevant companies or organisations that were missing. University technology transfer offices were also added to the list and classified as 'Incubators'. Other relevant university research centres and departments found were also included. The list was also then checked against a search of the Foundation for Research, Science and Technology databases of research abstracts and reports from organisations receiving funding from FRST.¹³⁸ Any missing organisations identified as being involved in the biotechnology sector were added to the list.

For each organisation on the list, the internet was used to find out more information about the organisation and to track down the email address of a relevant contact person in the organisation. If, upon learning more about the organisation, the activities of the organisation were not relevant to the survey, the

¹³⁸ <http://www.frst.govt.nz/Public/Reporting/>. The databases were searched using the terms "biotechnology" and "biotech".

organisation was excluded. Some organisations were found to have been originally misclassified by the Ministry of Research, Science and Technology. Companies that were wholly owned by an overseas company were excluded. This was partly for practical reasons in that many do not have a large research or manufacturing base here, and partly to ensure that the information collected focused on the issues faced by New Zealand companies and was not skewed by the activities of multi-national organisations.¹³⁹ Companies manufacturing or distributing devices only (such as ventilation or mobility devices) were also excluded from the list.¹⁴⁰ Most of the consulting companies were removed from the original list, as their business was not directly relevant to the biotech industry. Those consulting companies who remained on the list professed a special interest in biotech, or actually conducted research themselves.

In some cases, the email of an actual person could not be found and a generic one was used instead (e.g. info@sciencecompany.co.nz). Realising that it was better for the survey to go to an actual person, an effort was made to get the names and email addresses of a relevant person in the organisation. For example, for companies, the emails of the Chief Executive and/or the Chief Scientific Officer were found (if possible).

3.4 Distribution

A link to the online survey was emailed to 181 email addresses, some of which were to more than one person in an organisation, or were addressed to an organisation's generic email address. Fourteen emails were returned as undeliverable. These were removed from overall totals. Participants were contacted twice to participate in the survey, once by a generic email, and once by

¹³⁹ The companies office website (<http://www.companies.govt.nz>) was searched to determine ownership.

¹⁴⁰ While patents are undoubtedly of importance in these industries, the survey was focused on biotechnology patents (as defined by the OECD) rather than device patents, and the survey would therefore have been irrelevant to these organisations.

a personal email, sent and addressed personally to individuals identified as not yet having participated in the survey.¹⁴¹

The email introduced the project and the research, and asked participants to click a link to start the survey. The survey was then able to be completed online. Participants were given the option of having a paper copy of the survey posted out to them, and were requested to provide their postal details if they preferred this option. Four participants requested that a paper copy of the survey be sent to them, and all four participants returned the paper-based survey. The answers on the paper-based surveys were manually entered into the online survey by the researchers so that the responses could be compared with other online responses. Participants were encouraged to email the link to the survey to colleagues who they thought might be interested in participating.

3.5 The survey

An online format for the survey was used for the following reasons:

- there was a large and varied group of potential participants;
- the online survey format allowed for any potential overlap between activities of research and clinical diagnostics laboratories to be catered for;
- the online format allowed for 'snowballing' (i.e. people forwarding the link to the survey to other people);
- it was felt that the online format increased the likelihood of participation because for most people now, filling out an online survey is easier than a paper-based one; and
- the online survey could use 'skip-logic' to ensure people only answered questions that were directly relevant to their situation.

¹⁴¹ Because I was aware of the possibility of annoying people, personal emails were not sent to people in organisations identified as having already participated or partly participated in the survey. Of all emails sent (both personal and generic), approximately 22 were sent back as having been undelivered or to the wrong email address (i.e. where the person had left the organisation).

A copy of the survey is included in Appendix Two.

The survey contained around sixty questions, not all of which had to be answered by all respondents. Respondents were asked what they considered to be the primary activity of their organisation – research, providing clinical genetic testing services, or ‘other’. The answer to this question determined which parts of the survey they would then be directed to. Respondents in organisations primarily carrying out research were asked questions about the types of research their organisation did, the level of public funding they received, whether they paid licence fees or royalties in respect of activities carried out by their organisation, patent searching obligations, patent ownership and licensing out, difficulties with access to intellectual property, and their attitudes to the impacts of patents on research.

Research organisations which also provided clinical genetic testing services were directed to the questions aimed at providers of clinical genetic testing services, which covered the tests provided by the organisation, private provision of testing, the number of tests sent overseas, and tests developed in-house. Genetic service providers were also asked about whether they paid licence fees or royalties in respect of activities carried out by their laboratory, their patent searching obligations, difficulties with access to patented technologies, and their attitudes to the impacts of patents on the provision of clinical genetic testing services.

Respondents in the ‘other’ category were asked about their attitudes on patents within both the research and genetics services sectors.

3.6 Follow-up interviews

Respondents to the online survey were asked to provide their email address if

they would be willing to participate in a follow-up interview. Sixteen survey respondents did so. Nine of these agreed to participate in follow-up interviews. Interview topics are included in Appendix Three. Responses elicited from interviewees are included as appropriate throughout the results to elucidate themes that emerged in the online survey. In addition, I also met with a Senior Patent Examiner from IPONZ to discuss the practises of IPONZ and gain further information on themes that emerged in this research.

4 Results

4.1 Summary

There is much to be positive about from these results, despite the small sample size. Both researchers and providers of clinical genetic testing services are somewhat cautious in their attitudes to the impacts of patents on research and genetic testing. However, the information provided by participants generally indicates that, at present, New Zealand genetic testing services and research organisations are not negatively affected by patents or gene patents.

In particular, New Zealand research organisations:

- enthusiastically seek and maintain intellectual property portfolios, some very substantial, both in New Zealand and overseas;
- expend not insubstantial amounts of time and money searching for and assessing patents, usually to ensure freedom to operate;
- have a heavy to moderate reliance on existing patents to determine their choice of research;
- licence-in or pay royalties for very few patents;
- licence-out their own intellectual property on a much broader basis, with more than half of respondents indicating they held from five to over 100 out-licensing agreements; and
- rarely have difficulties in accessing intellectual property when needed.

However, in general, views expressed by researchers about the impacts of patents on research were fairly cautious, with most considering that patents had:

- decreased ability to publish; and
- increased the costs of research.

New Zealand public providers of clinical genetic testing services are not presently adversely affected by patents, or gene patents in particular. It would seem that, for now at least, the GTG case was a one-off occurrence. In addition, many of the patents identified by Cho et al as problematic have not been filed in New Zealand, meaning that these at least are not going to affect providers in future. It is speculated that those few problematic patents that have been filed in New Zealand are unlikely to be enforced in New Zealand due to the relative isolation and small size of the New Zealand market. In addition, there are no private providers of genetic testing services currently operating in New Zealand,¹⁴² so companies are probably reluctant to enforce their patents against a small public health system (for which licence fees and/or damages awarded by a court would be minimal).

Views expressed in both the survey and follow-up interviews supports the contention that patents provide an important incentive to innovate in the biotechnology sector.

The results for the biotechnology research sector are also consistent with findings by Nicol and Nielsen in Australia. While clearly this was a much smaller sample size, there are distinct similarities in the results that emerged from both research projects.

Views expressed by providers of clinical genetic testing services about the impacts of patents were mixed, with a majority of respondents considering that patents had increased the costs of genetic testing to patients and laboratories. However, a majority of respondents also considered that patents had:

- increased the quality of testing;

¹⁴² GTG has previously advertised the availability of its genetic tests for breast and ovarian cancer directly to some GPs and specialists.

- increased the ability to develop a test; and
- made genetic testing more accessible.

Overall, views expressed by respondents providing consulting, legal or other services to the biotechnology industry were generally positive about the impact of patents and genetic testing on research and clinical genetic testing services. A majority of respondents to this part of the survey considered that patents had:

- increased sharing of information among researchers;
- increased the quality of testing;
- increased the ability to develop a test; and
- made genetic testing more accessible.

4.2 Response rate

An email inviting participation in the online survey was sent to 181 email addresses to 94 separate organisations, many of which were to more than one person in a single organization. In some cases, the email was only sent to the generic organization address (e.g. info@biotechcompany.co.nz) where a personal email could not be identified. As also noted in the methodology, participants were contacted twice to participate in the survey, once by a generic email, and once by a personal email, sent and addressed personally to individuals identified as not yet having participated in the survey.¹⁴³ Of all emails sent (both personal and generic), approximately 22 were sent back as having been undelivered or to the wrong email address (i.e. where the person had left the organisation). These emails were removed from overall totals.

¹⁴³ Because I was aware of the possibility of bothering people, personal emails were not sent to people in organisations identified as having already participated or partly participated in the survey.

Table 1 below outlines the number of organisations emailed, the number of individuals to whom an invitation email was sent within that organisation, and response rate by individual response.

Table 1: Total organisations emailed, number of individual emailed in those organisations, and response rate by individual response

Classification	Number of organisations	Number of individuals emailed	Number of completed responses	Response rate (by individuals emailed)
Research	76	125	13	10%
Genetics services	5	12	4	33%
Other	15	26	10	38%
Total	94	163	27	16.5%

A total of 39 respondents from around 30 different organisations commenced the survey (i.e. answered at least the first three questions). This is an initial response rate of around 24%. A total of 27 respondents completed the survey, giving a ‘full complete’ rate of 16.5%. A ‘complete’ survey response was only recorded when the respondent clicked right through to the final page. There were therefore a few respondents who completed a majority of the questions but are not recorded in the ‘full complete’ rate. For this reason, responses from ‘partial completes’ are included in this analysis where appropriate.¹⁴⁴ In addition, some participants did not answer all questions, possibly because they could not answer the particular questions or did not want to.

In contrast to the Nicol/Nielsen survey, the same basic survey was available online for completion by all participants. However, the online format allowed for

¹⁴⁴ Respondents who started the survey but did not get to the end of it were recorded as having ‘partially’ completed the survey. Some respondents completed a large number of the questions, hence the reason for including their answers in the analysis.

'skip logic' to be used, meaning that respondents only answered questions that were relevant to them (depending on answers to previous questions). For example, if a respondent said that their organisation did not own any patents, they were not asked questions about their licensing-out activities. In addition, because of the smaller size of the New Zealand biotechnology industry, no distinction was made between companies and research institutes¹⁴⁵ – participants were distinguished by their primary activity:

- carrying out research;
- providing clinical genetic testing services; or
- other.

Total respondents for each section are given in Table 2 below.

A total of 17 respondents identified the primary activity of their organisation as being research, and 13 of those 17 went on to complete the entire survey. A total of six respondents identified their organisation as primarily providing clinical genetic testing services, and four of those respondents completed most of the questions in the genetic testing part of the survey. A further three respondents to the research questions indicated that their organisation also provided clinical genetic testing services, and two of these respondents went on to complete the genetic testing part of the survey.¹⁴⁶ The category of 'other' was intended to capture the views of persons providing products or services to the research and medical biotechnology industry. Sixteen respondents indicated they were in the 'other' category, and ten of these sixteen respondents completed the relevant part of the survey. The survey analysis below is divided into these three categories (research, clinical genetic testing services, other).

¹⁴⁵ Nicol and Nielsen distinguished between companies, research institutions, and providers of clinical genetic testing services, and slightly different surveys were sent to participants in the three groups.

¹⁴⁶ Three respondents initially commenced this part of the survey, but one respondent indicated that they only provided animal genetic testing, so did not continue with the rest of the questions in the survey.

Table 2: Total respondents

Primary activity	Genetic testing services¹⁴⁷	Research activities¹⁴⁸	Other services¹⁴⁹
Number of respondents starting the survey	6	17	16
Number of respondents completing the survey¹⁵⁰	4	13	10
Survey completion rate	66%	76%	62.5%

There are a number of potential reasons for the low response rate (and the high partial complete rate). The reasons for and implications of the low response rate are discussed in 9.4 below.

Because of the small number of participants in this survey, the responses discussed below have been generalised somewhat to protect the privacy of the individuals and organisations participating. The results are analysed and compared (where appropriate) with results from similar overseas research.

¹⁴⁷ Sector classification in database: Diagnostics.

¹⁴⁸ Likely sector classifications in database: Core biotech, Research institute, Services.

¹⁴⁹ Likely sector classifications in database: Consultant, Incubator, Legal, Supply. The main activities of respondents in this category were: providing legal advice (six); technology transfer (three); supplier to research sector (two); and consultant (one).

¹⁵⁰ This is the 'completed' number as recorded by the online survey provider. Many organisations filled out a majority of the questions but may not have clicked right through to the final 'completed' screen, meaning they were not recorded as complete. For this reason, the responses from 'partial completes' have been included in this analysis.

5 Clinical genetics services

The results presented in this chapter are organised in the following manner:

- Profile;
- Licensing in;
- Difficulties with access;
- Patent searching; and
- Attitudes towards patents.

5.1 Profile

Six of 37 respondents indicated that their organisation was primarily providing clinical genetic testing services. Not all six of these respondents completed the survey (although some may have completed some questions). As noted above, three of those who completed the research survey indicated that their organisation also provided clinical genetic testing services. These three were directed to this part of the survey. A total of six respondents (who were involved in both providing clinical genetic testing and/or research) completed this part of the survey, though not all six answered all questions. Taking into account the very small number of public providers of clinical genetic testing services in New Zealand,¹⁵¹ this response rate is reasonable. Respondents were well spread geographically, and represent the large majority of genetic testing services in New Zealand (by volume of tests provided).

Respondents indicated that a large range of genetic tests are provided.¹⁵² Research laboratories indicated much smaller ranges of genetic tests, usually

¹⁵¹ The Human Genetics Society of Australasia list of providers lists eight providers of clinical genetic testing services in New Zealand.

¹⁵² Many respondents did not indicate the individual tests undertaken by their laboratories, as there were too many tests to list. However, as noted in Appendix One, all of the tests (or

provided only in their field of research. Tests are done in-house, or sent away for analysis (e.g. to another laboratory in New Zealand or, in a small number of cases, overseas). Four respondents indicated that 76-100% of tests they provide are publicly funded. Two respondents did not answer this question. All genetic tests provided within the health sector are publicly funded (provided the patient meets the eligibility criteria). Tests provided by research laboratories (i.e. as part of a research programme) are likely also to be provided free of charge or at cost.

5.2 Licensing in

As discussed above, this research aimed to investigate the extent to which New Zealand clinical genetic testing services paid licence fees for particular patents, and if so, what the costs of such licences were.

Interestingly, all six respondents indicated that they did not pay licence fees or make royalty payments to any patent holder in respect of any of the genetic testing services provided by their organisation. However, one respondent noted that some licensing fees may be built into the costs of tests sent overseas. Another noted that they held a licence with GTG (but for which no licence fees are paid), and also indicated their belief that they may need to consider taking out a licence for some of their testing in future.

In contrast to the Nicol and Nielsen results,¹⁵³ even Roche's ubiquitous PCR patent did not feature in responses to this question.¹⁵⁴ One respondent noted in response to a later question that they had previously been approached by Roche who requested that they purchase a licence to the PCR patent, but this

variations of the tests) referred to in the Cho study as problematic are provided in New Zealand, though many are not patented.

¹⁵³ Nicol and Nielsen found that 9 of 11 respondents paying laboratory fees were paying for PCR/taq polymerase (owned by Roche): Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry."

¹⁵⁴ This patent (221517) expired in New Zealand on 20 August 2007, after the survey was sent out but shortly before the survey closed. In any case, it would seem that New Zealand laboratories were not paying licence fees for the use of PCR before the expiry of this patent.

respondent had decided to ignore their approach (but made financial provision). This situation was explained further in a follow-up interview. Roche had not pursued its license request further, likely, the interviewee reasoned, on the basis that the laboratory was already a very good customer in purchasing other laboratory equipment and supplies from Roche, and neither party would have wanted their existing commercial relationship to sour.¹⁵⁵

Both the New Zealand and Australian results are in marked contrast to Cho et al's findings, in which 27% of 132 laboratory directors in the US held a licence to perform a genetic test, including tests for the BRCA1/2 mutations, Canavan's disease, haemochromatosis and others. Sixty-nine percent of respondents to the Cho survey paid royalties to use a patented method or reagent.¹⁵⁶

Respondents were also asked whether they had ever coordinated or worked with another organisation in New Zealand to negotiate a joint licence for patents pertaining to the genetic testing services they provided. Four of six respondents had done so, with two citing the GTG patents as those at issue. Reasons for entering into the coordination were given by two respondents as "Government direction" and "save costs". It appears that there have been no other instances of coordination in the genetics services sector to negotiate licenses to intellectual property.

5.3 Difficulties with access

All six respondents indicated that a patent had never prevented them from developing or performing a test or providing a service. Respondents had never discontinued a genetic testing procedure because of a patent. This is in contrast

¹⁵⁵ Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation." discuss the importance for biotechnology organisations of maintaining their relationships in the sector. Where a patent holder does not need to maintain those relationships (for example, Miami Children's Hospital owning the Canavan's disease patent), they do not need to sustain good relationships and can therefore charge a higher royalty: p. 325-326.

¹⁵⁶ Cho et al., "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services."

to results from Cho et al, in which 25% of respondents to their survey of laboratory directors reported that notification from a patent holder had prevented them from continuing to perform a test.

However, two of six respondents indicated that they had received notification that the testing they were performing was the subject of a patent. For one respondent, the notifications were from Roche for PCR, and from GTG for its non-coding DNA patent. As outlined above, that organisation did not respond to Roche (but made a financial provision), and settled with GTG as per the terms of the settlement agreement outlined in Appendix Five. Another respondent had received notification for a patent covering “the analysis of a mutation in one gene in a panel of genes implicated in a genetic disorder”, and was, at the time of the survey, still considering their response. During the course of this research, this respondent negotiated a licence with an upfront payment and a small fixed royalty fee per test.

All six respondents indicated that they had never sought or requested a licence for any patents relating to the provision of genetic testing services. One of three respondents indicated that they had been offered a licence on restrictive terms (and the restrictive term was price), but that they had negotiated settlement on better terms.¹⁵⁷

Consistent with findings from Nicol and Nielsen, these results show that patent holders were generally not active in enforcing their patents against the New Zealand genetics services sector at the time of the survey. However, the fact that one respondent was currently considering its response to a patent holder at the time of the survey and subsequently agreed a licence must be viewed as a potential indicator that the licensing behaviour of patent holders towards providers of genetic testing may be changing in New Zealand. Having

¹⁵⁷ It might be assumed that the patent involved was GTG’s patent on non-coding DNA.

'conquered' the larger economies (such as the US), patent holders may see New Zealand, Australia and other small western countries as the next easy target.¹⁵⁸

5.4 Patent searching

This research also aimed to investigate whether providers of clinical genetic testing services carried out proactive patent searches, in part to determine whether they may be exposing their laboratory to legal risk (albeit very low) in offering a patented test.

Three of five respondents indicated that they took account of current patents on a particular test or gene when developing a new genetic test or service. These three respondents also indicated that their organisation expended money or resources searching for or assessing patents, but the amount expended on this was either not known or very low. Perhaps unsurprisingly, two of these three respondents were primarily involved in research rather than providing genetic testing services. Respondents in follow-up interviews indicated that the GTG case had not altered their patent searching practices – either they already undertook patent searches for their own research purposes, or occasionally undertook searches prior to introducing a new test (usually to investigate that test) – but that this behaviour had not changed as a result of GTG's approach.

However, apart from the GTG case, where it is fair to say that many organisations were surprised by the existence of the GTG patents, there is no evidence to suggest that patent searching behaviour in genetic services should change, largely because patent holders are not currently enforcing or filing patents in New Zealand.

¹⁵⁸ Or as I speculate in GTG's case, New Zealand was the first 'low hanging fruit' and an opportunity to get a country-wide license relatively easily.

Even if patent holders were to begin enforcing their patents against genetic services in New Zealand, the test volumes are so small that it would probably not be economic to collect the royalties. If enforced through infringement proceedings, section 71 of the Patents Act 1953 may reduce the likelihood of a claim for past damages where it can be shown that the infringer was not aware of and had no reasonable grounds for supposing that a patent existed at the time of infringement.

This provision will likely be retained in similar form in the new Patents Bill (clause 139), in which “a Court must not award damages or an account of profits for infringement of a patent if the defendant proves that at the date of the infringement the defendant did not know, and ought not reasonably to have known, that the patent existed”. The application of this clause to biotechnological inventions will prove difficult, as under clause 139:

- (2) *It is presumed that a person ought reasonably to have known that a patent existed if-*
 - (a) *a product is marked so as to indicate it is patented in New Zealand and with the New Zealand patent number; and*
 - (b) *the person knew, or ought reasonably to have known, of the product.*
- (3) *But there is no presumption if the product is marked merely so as to indicate that it is patented.*

As it currently stands, this clause presumes the existence of a ‘product’ that can be ‘marked’ to indicate that it is patented, and with a patent number. Unless significant advances in nanotechnology are made, marking biotechnological products and inventions with their New Zealand patent numbers will be impossible. This clause will therefore heavily favour researchers and geneticists, who can argue that they were not aware of a patented biotechnology product or process if they were not doing regular patent searches.

It is possible that New Zealand clinical genetics service providers are also, to some degree, relying on some form of research or public use exemption. A researcher also involved in the provision of a small number of genetic tests remarked:

"We are aware of gene patents in our area, and I conduct general searches from time to time, and in several cases [we have] contracted an Attorney to do these; I have no feel for the costs, but suspect they would amount to perhaps \$2-3000 total. But this is because we are interested in seeking our own IP on diagnostic tests, rather than avoiding doing research on patented areas. It is my understanding that academic research is not really subject to constraints on research due to patents, and this would only be an issue if we begin charging for a test or seeking our own IP which conflicts with existing IP." (emphasis added)

However, as discussed in section 8.1.3, a statutory research exemption does not yet exist in New Zealand, and such reliance, particularly in the case of research tools and genetic tests, is likely to be misguided.¹⁵⁹ Alternately, providers may be relying (again) on New Zealand's relative isolation and small market, which likely discourage patent-holders from enforcing their patents here. At this stage, it would appear that such reliance is certainly not misguided.

Follow-up interviews confirmed the survey finding that clinical genetics services laboratories undertake very few patent searches, largely because existing patents are not seen as a major threat or a pervasive issue. Similar to comments from researchers, one interviewee noted that Hazardous Substances and New Organisms Act requirements had caused more difficulties than patents.

¹⁵⁹ The European Society on Human Genetics also takes this position and cautions clinicians against relying on a research exemption "even if the test is performed with the public health sector and, notably, irrespective of whether money is exchanged or not": S Ayme, G Matthijs, and S Soini, "Patenting and Licensing in Genetic Testing: Recommendations of the European Society of Human Genetics," *European Journal of Human Genetics* 16 (2008).

Interviewees expressed the general sentiment that even if they were infringing a few patents, it would not be profitable for patentees to enforce their patents in New Zealand – it would be bad publicity and only small damages would be awarded (if any) since test volumes are so low.

A relatively low proportion of diagnostic facilities in the Nicol and Nielsen survey (12 percent overall, 23 percent of those conducting research) routinely conducted patent searches. Nicol and Nielsen speculate that one reason for the lower patent searching undertaken by research institutions and diagnostics facilities is due to a reliance on some kind of research exemption. However, Nicol and Nielsen note that this reliance may be somewhat misplaced, particularly in the case of research with a commercial goal.¹⁶⁰ Cho et al did not investigate patent searching behaviour amongst laboratories, but found that 53% had decided not to develop or perform a test/service because of a patent, suggesting that simple knowledge of current or future patents affected service provision.¹⁶¹

5.5 Attitudes towards patenting

Similar to the Cho and Nicol/Nielsen research, respondents providing clinical genetic testing services were asked to provide their views on whether patents have:

- made genetic testing more or less accessible to patients, or had no effect;
- decreased or increased the costs of genetic testing to labs, or had no effect;
- decreased or increased the costs of genetic testing to patients, or had no effect;
- decreased or increased the ability to develop a test, or had no effect; and

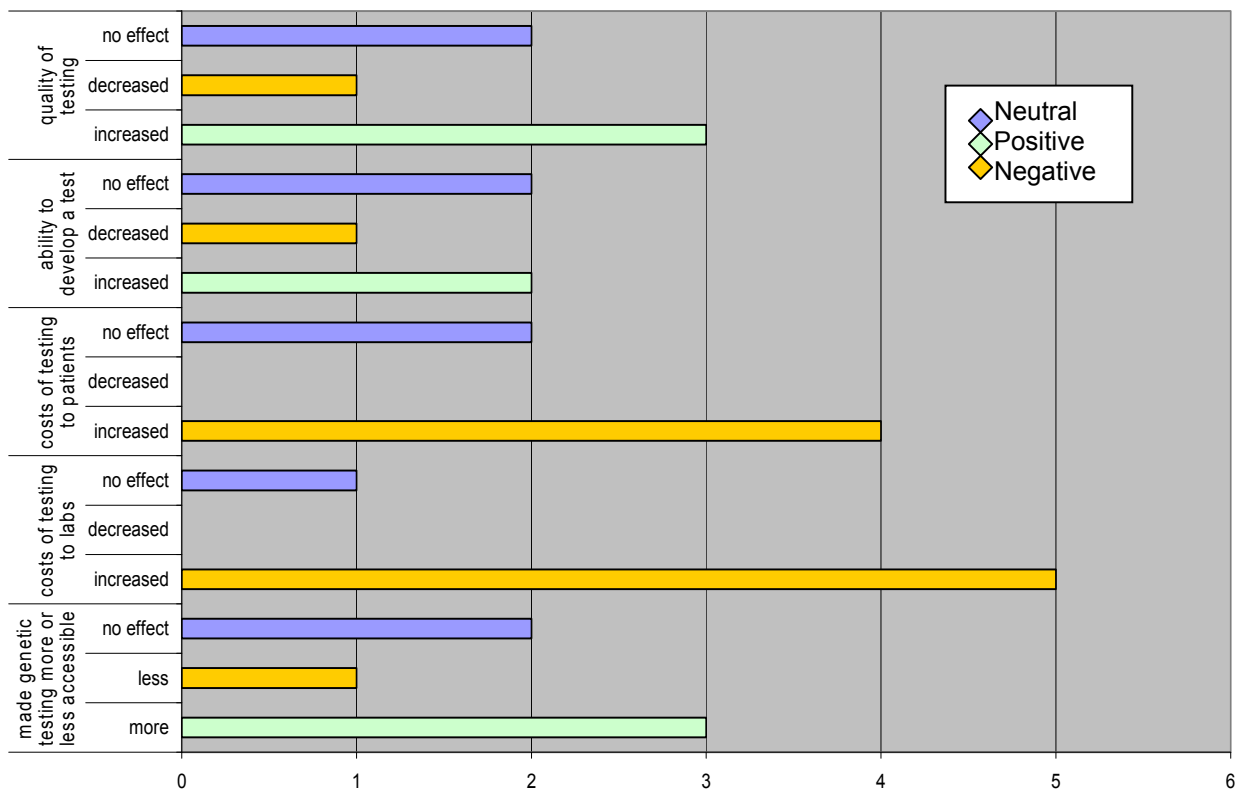
¹⁶⁰ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 178-179.

¹⁶¹ Cho et al., "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services."

- decreased or increased the quality of testing services in labs, or had no effect.

The answers from these questions are tabulated in Figure 1 below.

Figure 1: Views of providers of genetics services



It is interesting to note that five of six respondents considered that patents had increased the costs of genetic testing services to laboratories, when all six respondents earlier indicated that their organisation was not paying licence fees or royalties for any of the activities carried out by their organisation. It is also interesting that four respondents considered that patents had increased the costs

of testing to the patient, when very few genetic testing services were specified as being privately provided.

However, the questions did not specify that they were limited to New Zealand only, and respondents may have been taking into account the behaviour of international companies such as Myriad and GTG. Comments from some respondents also indicated a concern about their need to licence patents in future. Comments from both survey and interview participants indicated that anxiety shown in attitudinal responses was likely due to remaining initial concerns about existing patents (and their enforcement). For example, one respondent noted that:

“Despite all the initial concerns, we have so far had no adverse impact from patents as far as accessing tests for our patients in clinic (probably because we rarely use private providers).”

Another reason for some of the anxiety shown in attitudinal responses could result from more fundamental or ethical objections to gene patents in general. These objections are embodied in comments from a clinical geneticist, who stated:

“I’ll confine my comments to the effect of gene patents. I do not support the issuing of gene patents that inevitably seem to encompass mutation detection. I find the whole practice ethically corrupt. It stifles innovation and provides revenue for patent holders. Mutation screening of genes implicated in human disorders should be viewed as a public good outcome of fundamental research. The patenting of these genes, in contrast, appears to serve a privileged proprietary view of our heritage, in order to achieve a pecuniary outcome. The whole process is anathema to me.”

Nicol and Nielsen also found that respondents held a higher level of concern about the effects of patents than necessarily warranted by their earlier responses. Nicol and Nielsen speculated that this may have been due to the high media profile of the activities of GTG, including the announcement of its strategic alliance with Myriad, and concerns expressed on the ABC's Four Corners documentary by Francis Collins¹⁶² and others.¹⁶³

Cho et al's research was undertaken in the US healthcare system, and the opinions of respondents to their survey therefore are far more reflective of the commercial realities of the US private insurance-based healthcare system. The views of laboratory directors in the US, while overwhelmingly negative, were consistent with what Cho et al found to be occurring in the sector in regards to access and provision of genetic tests. Views of respondents in Cho et al's research were strongly negative as to the impact of patents on:

- access by patients to genetic testing (89% indicated a negative effect);
- the cost of testing to labs (96% considered patents had increased costs);
- the cost of testing to patients (91% considered patents had increased costs); and
- the ability to develop a test (91% indicated a negative effect).¹⁶⁴

¹⁶² Francis Collins is the Director of the National Human Genome Research Institute.

¹⁶³ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 202; Four Corners, "Patently a Problem: Transcript of Television Documentary," (Four Corners, 2003).

¹⁶⁴ Cho et al., "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services."

6 Research organisations

The results presented in this chapter are organised in the following manner:

- Profile;
- Licensing in;
- Anticommons issues;
- Impacts of licensing practices of patentees;
- Patenting practices;
- Licensing out;
- Incentive effects of patents in the biotechnology sector; and
- Attitudes towards patents.

6.1 Profile

Seventeen respondents indicated that the primary activity of their organisation was research. Of these 17, approximately 13 completed the research part of the survey in its entirety. This gives a completion rate of 76%, meaning that 76% of those who started the survey (i.e. answered at least the first three questions) completed it.

The types of research undertaken were fairly evenly spread across the following types of research (respondents could choose more than one answer):

- Gene identification (6);
- Cancer research (6);
- Virus research (1);
- Protein-based research (4);
- Plant/animal research (7);
- Bioinformatics (6);

- Other health research (5); and
- Other (4): genomics, genomics tools identification, analysis of genetic variation in disease and drug responses, glycobiology, and anticancer drug candidates and glycotherapeutics research.

Respondents to the survey received varying levels of public funding. Four of sixteen respondents indicated that none of their research received public funding. Three indicated that less than 25 percent of their research was publicly funded, and five indicated that 26-50 percent of their research was publicly funded. Four respondents indicated that their research was publicly funded by a proportion of 51% or more.

6.2 Licensing in

Previous New Zealand-based findings indicate that a relatively small proportion of New Zealand biotechnology organisations experience difficulties in accessing intellectual property – 9% of organisations in the *Biotechnology Survey 2007* identified “patent rights held by others/high licensing costs” as a constraint.¹⁶⁵

Respondents to this survey were asked about their licensing-in practices. In particular:

- whether they paid licence fees or royalties to any patent holder in respect of activities carried out by the organisation;
- how many licence agreements they have;
- for each licence where the licensor is based and whether the licence is exclusive or non-exclusive.

¹⁶⁵ Statistics New Zealand, "Biotechnology Survey: 2007.". This was an increase of 2% on the 2005 Biotechnology Survey results: Statistics New Zealand, "Biotechnology in New Zealand 2005."

Six of sixteen respondents (37%) indicated that they pay licence fees or made royalty payments to a patent holder in respect of activities carried out by the organisation. The numbers of licensing-in agreements held by these six organisations ranged from two to five agreements.¹⁶⁶ The particular technologies licensed in included PCR/taq, Marker Assisted Selection, Bovine SNPs, targeted mutagenesis, animal markers, and GTG's non-coding DNA patents. Some of these licenses were identified as being exclusive.

From responses to the survey and follow-up interviews, it did not appear that respondents considered licensing-in to be causing issues for research projects. Rather, licensing-in was just something routinely faced, and taken account of prior to commencing research projects. Nicol and Nielsen also found that respondents to their survey took account of the number of licenses to be negotiated prior to commencing a project, and that this was an important factor in determining whether or not a project went ahead.¹⁶⁷

Many interview participants noted that they would be likely to use patented technology without a license where the research did not have, or was unlikely to have, a commercial application. One survey respondent noted that difficulties with licensing were overstated:

"...the idea of an affordable licence fee doesn't seem to be well understood."

Nicol and Nielsen found a slightly higher degree of licensing-in among research institutes (52%) than companies (45%), but noted that technology transfer occurs predominantly through collaborative relationships rather than formal licensing.¹⁶⁸

¹⁶⁶ One respondent noted that they held 'indirect' licences through the purchase of particular enzymes and/or equipment.

¹⁶⁷ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 186.

¹⁶⁸ *Ibid.*, p. 184-185.

6.3 *Impacts of licensing practices of patentees*

While it seems that New Zealand respondents to this research license in very little intellectual property, particular types of patents and licensing practices have caused concern in the biotechnology industry.¹⁶⁹ These include:

- restrictive or exclusive licensing practices;
- breakdowns or delays in negotiations;
- difficulties licensing-in; and
- refusals to license.

This research therefore sought to investigate the extent to which New Zealand research organisations are affected by the above types of patenting and licensing practices.

6.3.1 *Notifications*

As background, respondents were asked questions to establish the degree of contact they had had from patent holders, and what their response to such contact had been. Six of 13 respondents indicated that they had been contacted by a patent holder regarding their organisation's potential infringement of a patent. However, in all but one¹⁷⁰ of these cases, the patent at issue was GTG's patent on non-coding DNA.

Only one respondent identified notification from GTG about their non-coding DNA patent as having prevented them from continuing to perform research. However, it is not clear whether the particular research was put on hold while negotiations with GTG were underway, or whether the research was stopped altogether.

¹⁶⁹ It should be noted that these particular licensing practices are not limited to the biotechnology industry. Another relatively new industry, computer software, has dubbed some patentors "patent trolls" for their aggressive licensing tactics.

¹⁷⁰ This respondent did not identify the relevant patent, citing confidentiality reasons.

Two of eleven respondents said that they had been involved in patent infringement litigation as a result of the research they were undertaking. In both cases the litigation was settled. Again, the patent at issue here is likely to have been the GTG patent. Clearly notifications and subsequent patent infringement litigation is not common in the New Zealand biotechnology research sector.

6.3.2 Breakdowns or delays in licence negotiations and difficulties licensing-in

A number of respondents (six of eleven) indicated that they had abandoned licence negotiations. The reasons given for abandoning negotiations included:

- failure to agree on price (2 respondents);¹⁷¹
- failure to agree terms (4 respondents);¹⁷²
- found another technology (1 respondent); and
- limits to value (1 respondent).

Three of twelve respondents indicated that they had experienced difficulties in gaining a licence to use patented tools or materials. The remainder of the twelve indicated that either they hadn't had any difficulties licensing-in (3), or that they had never attempted to license-in (6). Respondents indicated that difficulties licensing-in pertained largely to cost, threat of infringement, and unrealistic demands by the patentee. Interviewees noted that they had very few difficulties obtaining a licence where necessary, and that usually it was cheaper and faster to get a licence than to 'invent around' a patent in most instances.

¹⁷¹ One respondent cited "ridiculously high expectations of licence fees by licensor" as a reason, with another citing failure to agree on price.

¹⁷² Responses from two participants indicated that the negotiations were licensing-out negotiations rather than licensing in.

This 'abandonment rate' is higher to that found by Nicol and Nielsen, who asked respondents whether they had ever abandoned licensing-in a patent due to restrictive terms contained in the licence. Fourteen percent had abandoned licensing-in a patent, and eight percent had discontinued a particular aspect of research. Ten respondents to their survey were of the view that difficulties with licensing in did cause some inhibition of research.¹⁷³

There are a variety of difficulties that may be encountered in licensing negotiations. It is likely that these difficulties arise through inequality of bargaining position – though obviously if securing a license is crucial to the work of the company, a license is likely to be achieved – it depends on the importance of the intellectual property at stake.¹⁷⁴ These sentiments were expressed by a number of interviewees, though some interviewees also noted that due diligence on a project prevented any surprises, and that licensing issues were addressed earlier in a project rather than later, when a product might be nearing commercialisation.

6.3.3 *Refusals to licence*

Respondents were asked whether they had ever been refused a licence to a patented tool or product. Only one of thirteen respondents indicated that they had been refused a licence outright. The patent was identified as transformation technology (for plant promoters). The reason given for the refusal in this case was that the patent owner was keeping the technology for their own competitive advantage.¹⁷⁵ The refusal did not cause the respondent to abandon that line of research.

¹⁷³ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 161.

¹⁷⁴ Ibid., p. 162.

¹⁷⁵ One participant in Nicol and Nielsen's research noted three reasons why a licence might be refused: (a) the licence grant would conflict with the licensor's own business development; (b) the licence would be problematic in terms of finances or reputation in the market place; or (c) the intended application of the patented technology was unethical: Ibid., p. 148.

Consistent with the Nicol/Nielsen results, it would appear that refusals to licence are not a significant issue in the New Zealand biotechnology industry, or at least not among respondents to my survey.

6.4 *Anticommons issues*

As discussed previously, the preconditions to an anticommons do appear to potentially exist in New Zealand, with:

- growth in numbers of patents being filed;
- a number of research tools and upstream products being patented (although this appears to be occurring on a smaller scale in New Zealand); and
- fragmentation of intellectual property rights across smaller and smaller parts of biological products and processes.

Nicol and Nielsen also note two other factors that have contributed to the complexity of the patent landscape:

- an increase in the number and diversity of companies and other industry sectors filing patents;¹⁷⁶ and
- filing of defensive patents in respect of a single invention to create a “picket fence” around particular key technologies.¹⁷⁷

With the internationalisation of the patent system, and the importance of international trade, the extent to which these conditions are confined to a particular market is becoming irrelevant. Even if a company does not encounter the above difficulties in their home market, they may well do when attempting to

¹⁷⁶ New Zealand has seen an increase in governmental or quasi-governmental involvement in seeking and enforcing intellectual property rights.

¹⁷⁷ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", pp. 176-177.

sell their products overseas. This is particularly important for New Zealand companies, whose ultimate target markets are the United States, Japan and Europe.

Anticommons issues might therefore manifest in a number of ways, ranging from increased patent searching and due diligence obligations, through to a ‘tragedy of the anticommons’ – the abandonment of a project due to competing or overlapping patent rights. This research sought to investigate the extent to which such anticommons situations might exist in New Zealand, and to this end asked respondents questions about:

- their current patent searching practices;
- the influence of existing patents on their choice of research programme; and
- project abandonment or non-commencement due to patents.¹⁷⁸

6.4.1 Patent searching practices

Twelve of fourteen respondents indicated that they or another person in their organisation conducted regular patent searches to ensure that their research was not infringing patents held by others.¹⁷⁹ One respondent noted that this function was outsourced. Six respondents indicated that they had other reasons for conducting patent searches, including:

- seeking their own intellectual property;
- freedom to operate;

¹⁷⁸ There are other manifestations of an anticommons, most notably royalty stacking and reach-through rights to later inventions. Because of the difficulty of seeking information in survey form about these issues, they were not included in the online survey. However, they are likely to be addressed in follow-up interviews.

¹⁷⁹ This is similar to findings by Nicol and Nielsen, who found that 84% of company respondents and 50% of research institutions carried out patent searching. Because of the small size of the New Zealand biotechnology industry, our survey did not distinguish between companies and research institutions.

- commercial opportunities; and
- assessing the IP situation when a new field opens up.

The respondents who indicated that they carried out patent searches were asked to provide further information on the amount of time and money spent on such searching. The majority of respondents (ten of twelve) indicated that patent searching was carried out both in-house and by a patent attorney. In some cases, a considerable amount of time is spent on these searches. The amount of time spent on in-house searching ranged from two hours per month to 10 hours per week. Two respondents indicated that they conducted patent searches more sporadically rather than on an ongoing basis. Where patent attorneys were engaged, the costs of doing so ranged from \$2-3000¹⁸⁰ through \$10,000-\$20,000 (three respondents) and up to \$100,000 or more (three respondents) per annum. One respondent indicated that they spent approximately \$1 million per year on all intellectual property management (including the cost of a full time IP executive who carried out searches).

It is clear that a considerable amount of time and resources are expended on patent searching obligations. The views of respondents on whether they considered their patent searching obligations to be overly onerous or expensive were not sought in the survey. It was not clear from the responses to the survey that patent searching obligations have increased over time. These issues were addressed in follow-up interviews. In general, respondents considered that significant resource was expended on patent searching. However, all interview participants considered this expense to be a necessary cost of doing business in the field. As one Chief Scientist stated:

“It's a huge and variable expenditure. I think they're a cost of doing business but that they don't generate much return. Kind of like Nick Carr's

¹⁸⁰ From the wording of this response, this is likely to be the cost of a patent search in a single area, rather than the cost of ongoing searches.

analogy of Information Technology being like railroad transport or electricity: part of the infrastructure or operating cost but, because everyone is doing them, you've got to even if the investment is sometimes unjustified. There's also a problem of authentic authority: everyone who does patent searching and assessment but isn't a lawyer (e.g. me) cannot deliver an opinion that a business can rely on (from a governance and insurance point of view) and everyone who is a lawyer costs \$300/hour! It means we simply have to suck it up. We have discovered and in-licensed as a result of our searches so they've not been pointless, just expensive or sometimes irritatingly irresolute."

Respondents in follow-interviews indicated that their patent searching behaviour had not changed as a result of the GTG case, largely because they already took undertook comprehensive searches and assessments for their own purposes.

All respondents to the Nicol/Nielsen survey considered that patent searching was onerous and expensive. Some respondents also noted that the complexity of the patent landscape is increasing. However, views on patent search obligations were relatively divergent, with one respondent noting that patent searching had always been difficult, and was no more difficult now than 10 years ago. Other respondents noted the increased accessibility and ease of use of patent databases, which have made searching easier.¹⁸¹

Walsh et al found that many of their interview participants noted that searching for patents relevant to a particular research project and negotiating licenses was costly, time consuming, and increasingly complex. However, in real terms, Walsh et al conclude that "the patenting of research tools has not itself dramatically increased demand for legal resources and, by extension, that the

¹⁸¹ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 181.

transaction costs have not increased disproportionately".¹⁸² However, Walsh et al's analysis only seeks to compare recent years' expenditure (on attorney time per project) with previous years' expenditure, while neglecting the fact that the data they use¹⁸³ comes from a period of high growth and increased patenting within the biotechnology industry (1995-2001).¹⁸⁴ In addition, Walsh et al do not take account of the cumulative effect of the patents system, where because of the 20-year patent term, patents filed in 1994 will still have to be searched for and taken account of in 2014. Increases in the number and complexity of patents are therefore likely to have a disproportionate effect on the biotechnology industry, though because it is a new field, there is no real way of comparing current patent activity to previous patenting activity (e.g. prior to 1980) to deduce the transaction costs imposed by these patents. It may be more useful to compare patenting and licensing activity in the biotechnology field with another new field such as computer software.

With the increasing availability and ease of use of online patent databases (as also noted by respondents to the Nicol/Nielsen research), it is likely that increasingly, patent searches are carried out in-house by research or other staff. Patent executives would only then be engaged in the later, more complicated phases of projects. Comments from respondents to our survey certainly indicate

¹⁸² Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation.", p. 317.

¹⁸³ Data from the American Intellectual Property Law Association and the Biotechnology Industry Association suggested: a slightly more than 10% increase in the number of attorneys working on biotechnology between 1995 and 2001; a 25% increase in the amount of time (per the median) that each attorney commonly dedicates to biotechnology; and therefore a roughly 35% increase in the resources devoted to what could be labeled the 'transaction costs' of filing, enforcing and contracting for patents: *Ibid.*, p. 316-317. Walsh et al note, however, that in nominal terms expenditure by biotechnology firms on research and development has increased over 80% over 1994-2000. Using an annual research and development cost deflator of 5%, Walsh et al deduce that real research and development has increased by 40% per annum. Walsh et al therefore conclude that attorney activity per research and development dollar is not likely to have increased significantly in recent years.

¹⁸⁴ Indeed, it is likely that a larger number of biotechnology patents were filed and granted in the years 1994 to 2001, prior to the USPTO's increased utility guidelines being promulgated in 2002. Applications to the EPO for biotechnology patents grew by 5.1% per year between the years 1995 and 2003. However, the number of biotechnology patent applications decreased 7% for 2000-2003, compared with an increase of 13% between 1995 and 2000. Organisation for Economic Cooperation and Development, "Compendium of Patent Statistics."

a heavy reliance on in-house searching and assessment of patents by research staff before referral to external counsel. As one respondent noted:

“We are constantly monitoring research/patents through [a US-based research and advisory firm] and conduct regular searches ourselves through our Information Services department who run a number of search engines. Patent attorneys are too expensive for doing searches.”

While it appears that considerable resource is expended by New Zealand biotechnology organisations on patent searching and assessment, the general sentiment among these organisations is that this expense is a necessary aspect of doing business in the field. There was a degree of negativity around the costs of engaging patent attorneys, and some indication of increasing reliance on in-house and online assessments of the IP landscape prior to referral to patent attorneys.

6.4.2 Effect of existing patents on choice of research

Commentators have expressed concerns that the increase in numbers of patents, and patent overcrowding in particular research areas, has or will lead to whole areas of research being left untouched or abandoned because of reluctance on the part of researchers to negotiate numerous licences. One example cited is the CCR5 patent.¹⁸⁵ As Walsh et al note, “the concern is that knowledge of the reach of HGS’s patent could have deterred subsequent research exploring the role of the [CCR5] gene and the associated receptor.”¹⁸⁶ However, others would argue that the existence of relatively large numbers of patents in particular areas increases the effectiveness of research and ensures that research is directed to more appropriate (and potentially more commercially viable) areas.

¹⁸⁵ See note 98 above.

¹⁸⁶ Walsh, Arora, and Cohen, “Effects of Research Tool Patents and Licensing on Biomedical Innovation.”, p. 297.

Participants were therefore asked about the extent to which existing patents influenced their choice of research programme:

- Heavily: four respondents;
- Somewhat: five respondents;
- No influence: four respondents (thirteen respondents answered this question).

One interview participant (in a biotechnology consulting firm) noted the utility of the patent database as a source of information on research and new discoveries in any one field of research, and actively encouraged clients to search patent databases to get an overview of what competitors were doing in their area.

This sample is really too small to draw any general conclusions from. However, given the size of many biotechnology start-ups in New Zealand, and their reliance on strong intellectual property and research in unencumbered areas, it is not surprising that many respondents indicated a heavy to moderate reliance on existing patents to determine their choice of work. I also speculate that those respondents who said existing patents had no influence on their work are likely to be doing research in universities or other government or non-profit institutions. It is therefore possible that research in some areas is not being pursued in New Zealand because of existing patents. As can be seen below, a number of respondents note that they have interrupted (at an early stage) or not commenced research projects because of existing patents. However, it must be noted here that this is not necessarily negative – the existence of these patents either encourages researchers to ‘invent around’ the patents, thus increasing knowledge in the area, or forces companies into new research areas, again increasing society’s knowledge base.

6.4.3 Research not commenced

Another manifestation of anticommons issues is where projects are not commenced because of numbers of patents in a particular area, or difficulty with access to patents in particular areas.

Six of 15 respondents indicated that they had previously decided not to commence a research programme because of a patent or patents. Respondents were asked to identify which patents had affected their decision. Two respondents noted that identifying such patents prior to commencing research was simply part of the process of due diligence and ensuring freedom to operate. Other respondents stated:

- *“Numerous patents for genes in other species led us to omit them from our functional genomics work... Several technology patents have had a similar quenching effect”*
- *“For one programme we have re-organised where the research has been carried out. ... For other research we have stopped it completely.”*
- *“US 6,083,486 and US 6,592,847¹⁸⁷ ... A tentative/cancelled project on optical imaging of fluorescent probes in cancer”*
- *“Patents for similar or related gene targets”.*

While it is therefore clear that some research is not pursued due to the existence of patents, in most (if not all) cases early due diligence prevents research in encumbered areas being commenced, meaning that projects do not have to be abandoned further down the research track.

¹⁸⁷ Ralph Weissleder et al., "Intramolecularly-Quenched near Infrared Fluorescent Probes," (The General Hospital Corporation (Boston, MA), 2003), Ralph Weissleder et al., "Intramolecularly-Quenched near Infrared Fluorescent Probes," (The General Hospital Corporation (Boston, MA), 2000).

Nicol and Nielsen also asked respondents to their company survey whether their company had ever had to change its research program because a patent blocked access to key research tools or materials. Nine respondents (18%) reported that they had changed their research program, and many of these nine also indicated that existing patents had a heavy influence on their research. A number of interview respondents in the Nicol/Nielsen research considered blocking patents to be an issue within the industry, despite the fact that many of the respondents acknowledge engaging in defensive patenting themselves, as did a number of respondents to my survey.¹⁸⁸

6.4.4 Research changed or discontinued

As discussed, New Zealand researchers expend considerable resource on patent searching, usually to ensure they have freedom to operate. These patent searches do occasionally reveal patents that have prevented research from going ahead or limited the scope of projects. Even more problematic and costly is where relevant patents are discovered when research is well advanced, and the patent (and patentee) blocks access to necessary research tools or materials. Respondents were therefore asked whether their organisation had ever changed its research program (once research had already commenced) because a patent blocked access to key research tools or materials.

Four of 14 respondents indicated that they had changed a research programme once research had commenced because a patent blocked access to key research tools or materials. Comments from three participants indicated that either the patents had been identified early in the research in due diligence, or that once particular patents had been identified the company prepared to negotiate a licence rather than stop an active project.¹⁸⁹ This approach was

¹⁸⁸ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 140-142.

¹⁸⁹ One respondent noted that compliance with the Hazardous Substances and New Organisms Act 1996 and regulations had "been more obstructive than patents in this regard".

confirmed by interview respondents, who largely voiced a preference for attempting to negotiate a licence rather than abandoning research or inventing around a patent. This is similar to evidence from Nicol and Nielsen, who found that despite some level of project redirection to avoid heavily encumbered areas, there was “a general desire to find practical means to keep the stream of research and development going”.¹⁹⁰

The respondents who had changed their research due to a patent all indicated that patents had either a heavy or moderate influence on their choice of research program, and also all received less than 50% public funding.

6.4.5 Royalty stacking and reach-through rights

Two other manifestations of anticommons issues, royalty stacking¹⁹¹ and reach-through rights,¹⁹² were not directly investigated in this survey, largely because of the small size of the industry and the difficulty with collecting such data in a relatively short survey. Indirectly, respondents were asked whether and why licensing-in negotiations had been abandoned, which could have elicited responses about reach-through rights. However, reach-through rights were not specified by any respondent as a reason for abandoning licensing-in negotiations.

¹⁹⁰ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 189.

¹⁹¹ 'Royalty stacking' occurs when a company must take multiple licences to different patents for a single project. Too many licences (stacking) can undermine the commercial success of a product.

¹⁹² 'Reach-through rights' can take two forms. In the first, a patent may contain "reach-through" claims, which for example, might describe a target and claim any compounds acting on that target without describing what those compounds are. See Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation.", p. 297. These types of patents are much less common since the introduction of the USPTO *Utility Guidelines* (United States Patent and Trademark Office, "Utility Examination Guidelines."), but have still be known to cause difficulties for research. Reach-through rights may also be contained in licensing agreements, and can be, for example, rights to downstream products or royalties from those products. Accumulation of such rights can theoretically cause difficulties for companies as they seek to commercialise a product.

Interview participants had not encountered any royalty stacking or reach-through rights issues, but some noted the potential for royalty stacking issues to arise in future.

Nicol and Nielsen found caution amongst respondents to their survey on the subject of royalty stacking. Most noted the potential for royalty stacking to arise, and guarded against it where possible.¹⁹³ Walsh et al concluded that royalty stacking was unlikely to constitute “a significant or pervasive threat” to projects, but that it was a consideration in most projects.

Nicol and Nielsen did not encounter any complaints from respondents about the accumulation of reach-through rights, nor were they mentioned by respondents in either the survey or follow-up interviews carried out as part of this research.

6.5 Patenting practices

Organisations both in New Zealand and overseas have markedly increased their ownership of patents, particularly in the area of biotechnology.¹⁹⁴ Twelve of thirteen respondents confirmed that patenting was part of their organisation’s commercial strategy. Other methods identified as being used by respondents to protect their IP included:

- confidentiality;
- copyright;
- trade secrets;
- trademarks;
- plant variety rights; and

¹⁹³ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 191.

¹⁹⁴ Organisation for Economic Cooperation and Development, "Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies.", p. 36.

- designs.¹⁹⁵

Exponential growth in patent numbers in the biotechnology area has, in part, contributed to the increasing complexity of the patent landscape. This research therefore investigated the extent to which New Zealand research organisations also owned patents. All thirteen respondents (to this question) were aware of the requirements for patenting, and twelve of thirteen indicated that their organisation owned patents.¹⁹⁶ Some respondents found it difficult to identify how many patents were owned by their organisation,¹⁹⁷ but other answers ranged from very few (less than 5) to around 100 and right through to “200 families” and “approximately 450”. Some respondents distinguished between granted patents and those at the provisional stage, with four respondents identifying that they held provisional patents. This information is certainly not a quantitative measure of patent ownership by biotechnology organisations in New Zealand. However, it provides a picture of the patenting behaviour of participants in the survey, and contextualises their responses to later questions.¹⁹⁸

This research also investigated the extent to which New Zealand research organisations regularly patent their products overseas. Nine of ten respondents indicated that their patents were registered overseas. Some respondents noted that the place of registration depended on the target market, but many identified the United States, Europe, Japan and Australia as the countries they would usually register their patents in.¹⁹⁹ Follow-up interviews indicated that overseas patent filings were of far greater importance than New Zealand patents. When

¹⁹⁵ It is interesting that a variety of methods to protect intellectual property are used. One person in the sample group who did not complete the survey also commented that their company used trade secrets to protect their intellectual property, rather than patents.

¹⁹⁶ Similarly, Nicol and Nielsen also noted a high rate of patent ownership among Australian companies (76 percent) and research institutions (82 percent): Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 76.

¹⁹⁷ Possibly because these respondents were from large organizations (such as universities).

¹⁹⁸ A better source of patent ownership in the biotechnology sector on a per-organisation basis can be found in Statistics New Zealand, "Biotechnology Survey: 2007."

¹⁹⁹ This is also consistent with OECD statistics on international patent filing trends for New Zealand: Organisation for Economic Cooperation and Development, "Compendium of Patent Statistics.", p. 20.

prompted, one interviewee agreed with my suggestion that their company only filed patents in New Zealand for 'sentimental reasons'.²⁰⁰

Consistent with OECD statistics, it would seem that, at least in the case of respondents to my survey, New Zealand research organisations enthusiastically seek and maintain intellectual property protection in many spheres of research, with some organisations holding a substantial number of patents.²⁰¹ However, while growth in the number of patents has been characterised negatively by some (in the biotechnology sector at least), New Zealand's contribution in this regard is still relatively minor, and can hardly be seen as negative. Indeed, some would argue that patent ownership and other forms of intellectual property protection are crucial in maintaining New Zealand's standing in the international biotechnology industry. As discussed below, such intellectual property protection may also help to encourage investment in biotechnology by both the New Zealand Government and the private sector, and is likely to make New Zealand biotechnology products highly marketable overseas (provided overseas patent protection has been obtained).

Combined with the growth in numbers of patents in this area, there has also been a rise in strategic or defensive patenting. Nine of twelve respondents had applied for a patent for strategic reasons. Reasons identified by respondents for doing so included:

- establishing early priority in the face of known competition;
- leverage for licensing out;
- building a defensible IP position;

²⁰⁰ Similar sentiments were expressed by a respondent to Nicol and Nielsen's research, hence the prompting.

²⁰¹ In 2006, the OECD reported that New Zealand ranked fifth among all other countries for numbers of biotechnology patents filed as a percentage of total international Patent Cooperation Treaty filings: Organisation for Economic Cooperation and Development, "Compendium of Patent Statistics.", p. 20. In 2007, New Zealand increased its position in these rankings to fourth behind Canada, Denmark and Finland: Organisation for Economic Cooperation and Development, "Compendium of Patent Statistics."

- publication;
- freedom to operate;
- blocking competitors;
- to take a strategic position to assist in negotiating with potential collaborators and other parties;
- to get funding.²⁰²

It would appear therefore, that strategic or defensive patenting is relatively commonplace within the biotechnology research sector in New Zealand, or at least among the respondents to my survey. Respondents in both the Walsh and Nicol/Nielsen research acknowledged that a large amount of strategic or defensive patenting takes place within the biotechnology industry. Nicol and Nielsen asked respondents whether they had ever applied for a patent for strategic reasons. Forty-three percent of respondents to their company survey said they had done so. In addition, many interview respondents noted that they had patents on their books that they did not exploit.²⁰³

A respondent to Walsh et al's research considered that some form of defensive patenting was almost necessary to stay in the industry:

*"I suppose because we see everyone doing it [defensive patenting] in part. Sort of like the great Oklahoma Land Rush. If you don't do it, you're not going to have any place to set up a tent, eventually."*²⁰⁴

²⁰² Areas in which strategic patents were applied for included:

- gene sequence;
- research tool;
- gene product;
- drug;
- diagnostic; and
- other (prognostic test, animal health, environmental, various).

²⁰³ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 168-169.

²⁰⁴ Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation.", p. 295. The particular respondent was from a large US pharmaceutical firm.

This attitude was reinforced by a number of interviewees in this research, who regarded defensive patenting as absolutely necessary in the industry. One interviewee characterised ringfencing²⁰⁵ (through patenting) as a characteristic of the progression of research, where one molecule is discovered and patented in the early stages of research, and then as research progresses further patents are filed on the components of the invention or surrounding inventions. This functions to protect the invention itself but is driven by the progress of research on the whole product. The interviewee noted that such incremental patenting was also due to resource constraints and the cost of patenting.

6.6 Licensing out

The twelve respondents who indicated that their organisation owned patents were asked about the extent to which they licensed out their intellectual property, what types of licences they commonly granted, and where licensees were based. Eleven people responded to the question on whether they licensed out their patented tools and products. Of those eleven, six respondents indicated that they held outlicenses.

This proportion of respondent organisations who license out their patents (57 per cent) is similar to that reported by Nicol and Nielsen, who found that of the 20 research institutions (responding to their survey) who owned patents, 12 reported licensing out activity (60 percent). Of the 48 company respondents to the Nicol/Nielsen survey, 19 reported out-licensing activity (40 percent).²⁰⁶

²⁰⁵ 'Ringfencing' describes the use of patents to build a fence around a particular technology or research area.

²⁰⁶ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 78 and 100. Four additional company respondents noted that they were currently negotiating out-licenses.

The numbers of licensing out agreements held by respondents varied, ranging from five to in excess of 100.²⁰⁷ Respondents were asked to identify the types of licences they most commonly grant. Interestingly, the most common type of licence was “exclusive commercial” (four of six respondents).²⁰⁸

Respondents were also asked whether they had ever refused to grant a licence to a patent they held. Three of nine respondents indicated that they had refused to grant a licence. However, two of these respondents indicated that failure to agree commercial terms was the reason for the refusal,²⁰⁹ and only one indicated that the refusal was to maintain competitive advantage.

It is interesting that a slightly larger proportion of respondents to this survey indicated being involved in out-licensing than the proportion indicating their involvement in in-licensing. For this group of respondents at least, one might speculate that research organisations are benefiting overall from a lack of patent granting and enforcement on the part of overseas companies. This is possibly due to New Zealand’s relative isolation and small target market, meaning that overseas companies are reluctant to apply for and enforce their patents in New Zealand.

²⁰⁷ One could assume that the number of licensing out agreements might depend on the size of the company. However, because I did not collect information on the size or turnover of organisations (for commercial confidentiality reasons), one could not necessarily draw this inference from the results of this survey.

²⁰⁸ Nicol and Nielsen also sought information from Australian companies and research organisations about their licensing practices. Similar to New Zealand, they found that exclusive licensing out arrangements are common in the Australian biotechnology industry. Further information from interviews conducted by Nicol and Nielsen confirmed that licence exclusivity depends largely on: the nature of the invention being licensed; the negotiating power of the respective parties and their position in the drug or therapy development pipeline; and the nature and number of potential licensees.

²⁰⁹ It is arguable that a failure to agree commercial terms is indicative of negotiation breakdown rather than a refusal to license. Two respondents also noted that out-licensing negotiations had broken down in answer to another question.

6.7 Incentive effects of patents in the biotechnology sector

There is evidence that patents provide a strong incentive for investment and research in the biotechnology and pharmaceutical industries. While this issue was only briefly addressed in the survey, many respondents made reference to the important role that patents have played in fostering research and innovation. For example:

“It’s hard to see how biotech would have got to where it is (for good or bad) without patenting though. It’s like questioning the air...”²¹⁰

Three themes emerged in comments, centering on the roles patents play in stimulating investment, increasing knowledge diffusion, and bringing genetic tests to market.

On stimulating investment, respondents commented:

“Patenting provides the principal lure for private investment in Biotech. Without it, research funding would rely more heavily on the government purse.”

“The prospect of commercial returns (patenting assumed) encourages funding from a variety of sources including Governments.”

“I note that most of the negatives patenting are direct and clear: stifled communication, inhibited research, etc. Whereas most of the positives for biotech patenting are less direct e.g. encourages companies (maybe) to invest more (maybe), allows universities (maybe) to get revenue which (maybe) they put into social improvement such as teaching, etc.”

²¹⁰ Respondent to research section of the survey.

On increasing knowledge diffusion:

“...in reality I think that most people do not understand the requirement for mandatory disclosure and how this assists advancement, and that without patents society would not be so far developed because there would be no incentive to innovate because your invention would be copied two seconds later by someone who had very little invested in research and development.”

“Patents and applications put information into the public domain on publication. The information is widely shared in an on-line world.”

“All patents are published. Furthermore, the tough utility requirements, especially in the US, means that patent applications contain much more data that might ordinarily be published. This means that a lot of data actually becomes public knowledge that otherwise would be held as trade secrets. Researchers oftent fail however to utilise patent databases as sources of information. It should be kept in mind that the aim of patents, in trade off for the monopoliy is that all information relating to the invention becomes public knowledge.”

And particularly in encouraging the development of new genetic tests:

“...without a patent the gene test will never be properly developed and made available for routine use, so it is virtually de rigeur to pursue patents in this area and I do not see this as negative.”

“I suspect that these tests would not have been developed at this time if there were no patents covering these and earlier manifestations of these tests.”

“Existence of patents may inhibit development and application of tests by local labs, but the opportunity of obtaining a patent offers an incentive for developing novel tests.”

“Patenting means more biotech innovations are likely to benefit mankind i.e. due to the large quantum of investment required to get a therapeutic or a diagnostic to market, it is unlikely to be supported through regulatory requirements unless payment rights exist to support investment returns.”

These sentiments were also expressed in follow-up interviews. One participant noted that while patents were extremely important to their business activities, they were only financially able to patent a small proportion of their inventions, largely because of the costs associated with engaging a patent attorney to draft and file the patent (~\$20,000NZ). Another interview participant (in the biological life-sciences area) noted that patents were less important now than they had been to the company’s previous business strategy:

“For a time we were, in our mission and purpose, an “IP generating company”. At that time [patenting] played a huge role. Now it's less so, because some of our research is industry good. Mostly we are targeted at improving performance of biological systems on-farm in New Zealand so the value of patents is less that it might be - we are expected to generate our returns into the farmers' pockets rather than back to our parent so do not have such a fierce imperative to lockdown IP and milk the resulting monopoly. But it is still important because there is overseas revenue to be made or IP to be swapped.”

It is therefore clear from the above that participants in the survey do consider patents to play an important role in incentivising research, therefore supporting the findings from research in the area (see section 2.5.4). The comments from the above interview participant (and other interview participants) also support the

contention that business models in the biotechnology sector are moving away from relying on monopolising intellectual property and towards the development of useful saleable products.

6.8 Attitudes towards patents

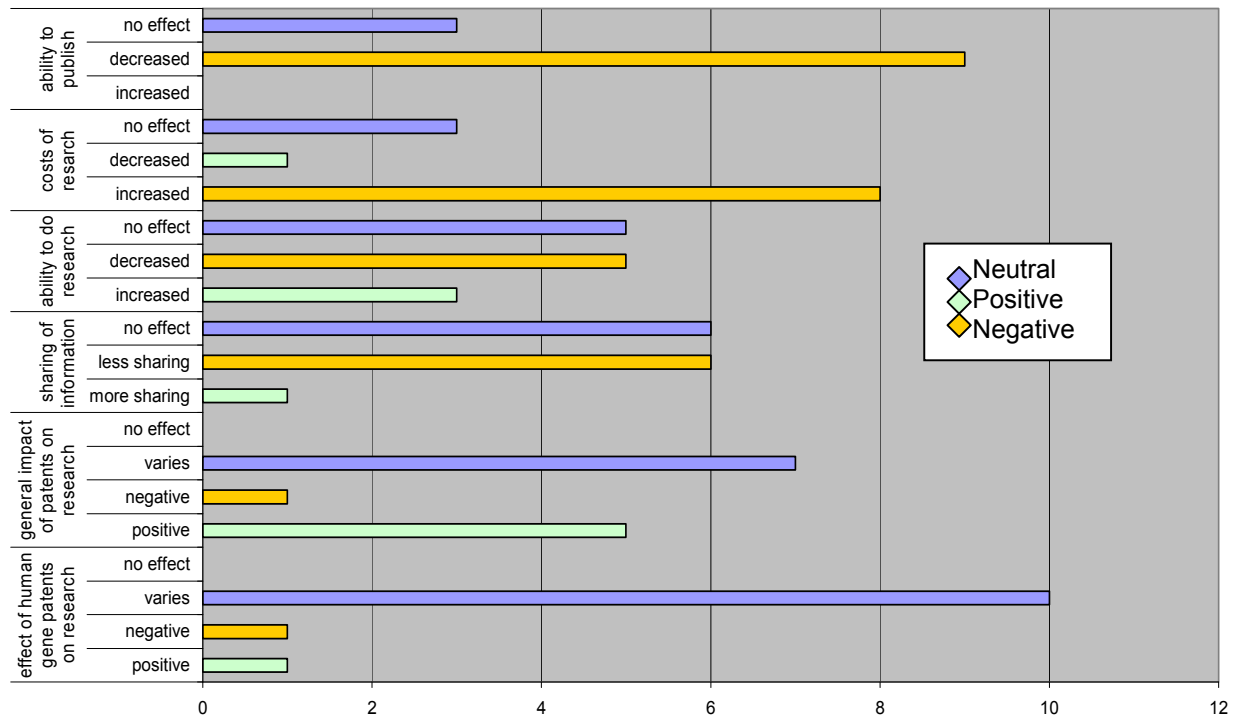
Respondents who identified their primary activity as research were asked to provide their views on whether patents have:

- resulted in more or less sharing of information among researchers, or had no effect;
- resulted in an increased or decreased ability to do research, or had no effect;
- decreased or increased the costs of research, or had no effect;
- decreased or increased researchers' ability to publish research results, or had no effect;
- had a positive, negative or variable impact on research in general, or had no effect;

Respondents were also asked what they considered to be the effect of human gene patents on research.

The answers to each of the above attitudinal questions are tabulated in Figure 2 below:

Figure 2: Views of researchers on impacts of patents



Participants were asked to comment on the effects of patents, or gene patents in particular, on biotechnology research in New Zealand. While a few comments noted that publication of research findings was inhibited or delayed by an organisation’s desire to patent, most respondents noted the beneficial effects of patents for research, in particular:

- patents encourage investment in research;
- patents allow universities to collect revenue, which they possibly invest in teaching;
- without patents, genetic tests would not be properly developed and made available for routine use.²¹¹

²¹¹ These comments are discussed in 6.7 above.

Two respondents noted that broad and problematic patents had previously been granted, particularly in the area of diagnostic genetics, but one of these respondents noted that such patents had not caused a particular problem for their laboratory. One respondent noted that the introduction of stricter utility criteria (presumably the USPTO's Utility Guidelines²¹²) had reduced the number of gene patents being granted.²¹³

Respondents were also asked what they considered to be the impact of allowing the patenting of biotechnology inventions on research in this industry. Of a total of eleven respondents, four respondents considered the impact to be positive, and seven considered the impact to vary. In general, respondents to a similar question in the Nicol and Nielsen survey viewed patents as having a positive effect on research, much more so than those who considered patents to have a variable impact.²¹⁴

More specifically, ten of eleven respondents considered that the effect of human gene patents on research also varied. One respondent considered the effect to be positive. Nicol and Nielsen also asked respondents for their reactions on other types of patents, including research tools, gene products, drugs, diagnostics and other. They found that respondents to their survey were more concerned about the impact of gene patents on research than any other type of patent.²¹⁵ Due to the relatively small size of the New Zealand biotechnology

²¹² United States Patent and Trademark Office, "Utility Examination Guidelines."

²¹³ The extent to which IPONZ takes account of USPTO examination practices is unclear; in discussions an IPONZ Senior Patent Examiner indicated that IPONZ look much more to Europe for examination guidance. Undoubtedly, however, the *Utility Guidelines* (note 212) increased the quality of patents being filed.

²¹⁴ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", pp. 82-85. Fifty and sixty-eight percent of research institutions and companies respectively considered patents to have a positive effect, while only seventeen and fourteen percent of research institutions and companies respectively considered patents to have a variable effect. Only one company (2%) and four research institutions (18%) considered patents to have a negative effect.

²¹⁵ *Ibid.*, p. 83.

industry, respondents were not asked to compare the impact of different types of patents.²¹⁶

Overall, the answers given to the attitudinal questions indicate that in general, researchers are somewhat less than positive about the effects of patents on some aspects of research, particularly in relation to the sharing of information among researchers, publication, and increasing the costs of research. Of particular note, eight of eleven respondents (72%) considered that patents had decreased researchers' ability to publish research results, or at least had an effect on the timing of publication.²¹⁷ For example:

"Patents may delay sharing of information among researchers, can definitely cause delays in publishing results of research."

"Patenting changes the structure of research progress; in its absence, research progress is seamless but slower. In its presence, progress tends to "hop" or go into tunnels. That is, there can be a certain lack of communication, then, on the appearance of a product (be it a test, tool or drug, the subject of the IP), everything surges forward."

Eighteen percent of research institution respondents to the Nicol/Nielsen survey considered patents had had a negative impact on their ability to publish research results.²¹⁸

However, as outlined in 6.7 above, many also noted the effects of patents in incentivising innovation and encouraging investment in research.

²¹⁶ This research also had a particular focus on the effects of gene patents on research and genetic testing in New Zealand.

²¹⁷ As indicated in comments from respondents.

²¹⁸ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 126-128.

7 Other organisations

The purpose of this section of the survey was to gain further information about the attitudes towards the impact of patents in the biotechnology and genetics services sector of those organisations and people providing products and services to the research and medical biotechnology sector. The attitudinal questions were largely the same as those asked to each of the research and genetic testing services respondents. However, respondents to this part of the survey were given space for comments after each attitude question. By including these participants in the survey, it was intended they would provide, possibly, a broader perspective on what was occurring in the sector. Because a majority of respondents in this section are not directly involved in research (see profile of respondents below), much of these answers are unlikely to be based on first hand experience in the research and genetics services sector. Rather, the attitudes are based on their experiences in their own professions, usually as consultants, lawyers or technology transfer officers.

7.1 Profile

Sixteen of 39 respondents to the initial questions of the survey indicated that they were in the 'other' category. Ten respondents in this category completed the survey, though not all respondents answered all questions. The main activities of respondents in this category were:

- providing legal advice (six);
- technology transfer (three);
- supplier to research sector (two); and
- consultant (one).²¹⁹

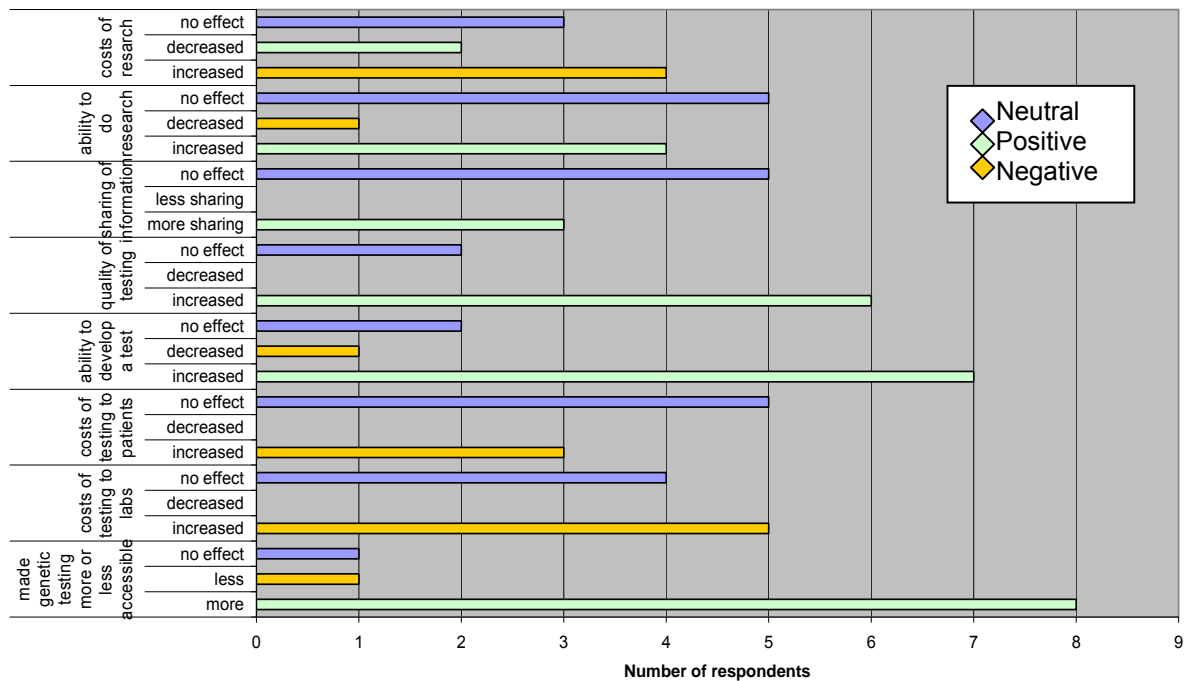
²¹⁹ One respondent also indicated that they were involved in research and clinical genetic testing, possibly indicating that they had mistakenly selected 'other' rather than 'research'.

7.2 Attitudes towards patenting

Overall, views expressed by respondents to this part of the survey were generally positive about the impact of patents and genetic testing on research and clinical genetic testing services. A majority of respondents considered that patents had:

- increased sharing of information among researchers;
- increased the quality of testing;
- increased the ability to develop a test; and
- made genetic testing more accessible.

Figure 3: Views of 'others' on impacts of patents



As can be seen from the above, most respondents to this part of the survey considered that patents had either had a positive effect or no effect on particular aspects of research and genetic testing.²²⁰ In particular, a majority of respondents considered that patents had made genetic testing more accessible, and had increased the quality of and ability to develop a test. It was also noted by respondents that in some cases patents are not filed in New Zealand, representing an advantage for New Zealand in being able to develop and use particular tests without seeking a licence.²²¹

7.2.1 Costs of research

Four respondents considered that patents had increased the costs of research, two considered that patents had decreased the costs, and three considered that patents had had no effect. Respondents noted that while pure research was usually not inhibited by patents (due to an assumed research exemption or licenses being available at no charge), the cost of patenting could increase costs where it is intended that the research be commercialised.

7.2.2 Ability to do research

Four of ten respondents considered that patents had resulted in an increased ability to do research in general, with five considering that patents had had no effect, and only one stating that patents had decreased the ability to do research. Respondents commenting on this question noted that it was a complex question, with many subtleties and contingencies. For example, one respondent noted:

“This is actually a very complex question, as the most obvious and immediate answer is probably a decrease. However, you need to factor in how much of the core research that underpins other areas would not have

²²⁰ It must be noted, however, that the majority of respondents to this part of the survey were providing legal and probably patenting advice to the medical research sectors.

²²¹ See Appendix One for an analysis of patents granted in New Zealand.

gone ahead, or found investment, had patents not been available to protect investment. Furthermore ... without the compulsory publishing of patent applications, much more information and critical know-how would stay as trade secrets.”

7.2.3 Sharing of information

Five of eight respondents considered that patents have no effect on the amount of sharing of information that takes place between researchers. However, a number of respondents in comments noted that sharing of information is delayed until patent protection is obtained. Two respondents noted that the act of patenting was a form of sharing of information in itself, with one lamenting “[r]esearchers often fail however to utilise patent databases as sources of information”. The importance and usefulness of patent databases as a source of information was also discussed and reinforced by interview participants.

7.2.4 Quality of testing

A large majority of respondents (eight of ten) considered that patents have made genetic testing more accessible to patients. This is very similar to the response from providers of clinical genetic testing services (where all five respondents considered patents had had no effect or made genetic testing more accessible). Further, many respondents noted that it is likely that the tests would not have been developed had patent protection not been available. Some respondents also noted the importance of intellectual property protection for investor confidence.

7.2.5 Ability to develop a test

Seven of ten respondents considered that patents had increased the ability to develop a genetic test. Respondents again noted in comments that patents

provide the incentive for investment in research, without which a number of these tests would not have been developed. Other comments noted that patents also increased the general knowledge in the field, allowing others to build on research and make further discoveries and refinements.

One respondent also noted that New Zealand held a potential advantage in this regard:

However, very few patents are actually filed in New Zealand. In some cases, where patents exist overseas but not in New Zealand, the lab can simply gain the benefit of technology to help them develop their own test – if the overseas patent did not exist they may not have otherwise had the benefit of the information provided in it.

As discussed in Appendix One, many gene and research tool patents identified as problematic or having far reaching effects have not been patented in New Zealand. It is therefore possible, that in the sphere of medical biotechnology at least, New Zealand firms are benefiting from patents not being filed or enforced in New Zealand. Interview participants concurred with the theory that some patents have not been filed in New Zealand. However, most considered that this situation was changing, with more and more companies filing their patents in New Zealand:

*“Certainly true [that New Zealand is benefitting from isolation and small size], but probably getting less true over time. I suspect it is an artefact of American patent practice. Since until recently 90% of all biotech took place in the US it's easy to see why many didn't bother to patent outside the US (where, even if research is elsewhere, the major financial gains are to be made - especially in medical biotech) and, when they did, they went to Europe, Japan, occasionally Australia. ... That *is* an advantage in this particular instance. For example, there is no need to purchase a licence*

from Japan Tobacco to do monocot transformation using Agrobacterium in NZ because they don't have the patent here - Australians, Europeans, Americans etc all need to pay the licence. But PCTs with just about every country listed are much more common now so the advantage is disappearing.”

7.2.6 Costs of testing to laboratories and patients

Five of nine respondents considered that patents had increased the costs of testing to laboratories, and four considered that patents had had no effect. Of eight respondents, three considered that patents had increased the costs of testing to patients, and five considered that patents had had no effect.

In the comments a number of respondents noted their lack of direct knowledge in this regard. Two respondents noted that if the tests are to be developed, there is a need for patent protection to provide the necessary incentive. Again, it was noted that New Zealand might be benefiting from patents not being filed in New Zealand.

7.2.7 Accessibility of genetic testing

Of ten respondents, eight considered that patents had made genetic testing more accessible to patients, with many respondents noting in their comments that many of the tests would not have been developed without the investment incentive provided by patents. One respondent noted that in New Zealand patents have very little effect on accessibility of genetic tests due to government “gatekeeping ... of laboratory schedule funding”.

7.2.8 Impact of patenting biotechnology inventions

Respondents were asked what they considered to be the impact of allowing the patenting of biotechnology inventions on research in the industry. Five of ten respondents considered the effect to be positive, while four considered the effect varies, and one considered that patents had no effect. All six comments again cited the importance of patents for encouraging investment in research:

“The rate of development would be slowed if there were no patents because there would be no disclosure of information, no return on any research done because it could automatically be copied in generic form, and therefore no incentive to improve research.”

7.2.9 Effect of broad patents on research

Participants were asked an open-ended question about what they considered to be the effect of broad patents on research. Most respondents noted that in general, broad patents were undesirable because of their ability to stifle research or at least increase the costs of research. However, many also noted that such broad patents were no longer being granted, and were also less likely to be enforced, and easily challenged. Two respondents placed the onus back on to researchers to choose fields of research where they have freedom to operate or to seek licences where appropriate. One respondent noted the existence of a defence to infringement if the invention has been used for research purposes.²²² Another respondent noted that such patents have minimal impact on research in the public domain, while in the private domain their impact is to increase research “as they provide investors with the confidence to invest”.

²²² However, as explored in section 8.1.3, the extent of the experimental use exemption and its application is unclear.

8 Legal and structural approaches to patent problems

This section examines some of the main legal and structural approaches proposed to facilitate access to necessary intellectual property in the areas of biotechnology and genetics. It is not clear from the results outlined above however, that New Zealand is experiencing significant problems with patents in either the biotechnology or genetics services sector. While one needs to recognise that problems experienced elsewhere may simply be yet to reach New Zealand, the only 'solution' to be examined in great detail in this chapter is the introduction of an experimental use exemption. Such an exemption is likely to be introduced as part of a new Patents Bill, and a close examination of the rationale for its introduction and possible impact is therefore warranted.

8.1 Legal approaches

This section discusses various legal approaches mooted (and used) to mitigate the negative impacts of patents in the area of medical biotechnology. These include:

- the use of compulsory licensing;
- exclusions from patentability;
- the experimental use exemption.

As discussed below, the New Zealand Government has determined that a statutory experimental use exemption should be introduced to clarify the current common law experimental use exemption currently in existence in New Zealand. The history of the common law experimental use exemption both in New Zealand and overseas is outlined in Appendix Six.

8.1.1 *Compulsory licences and Crown use provisions*

It is worth noting the compulsory licence and the Crown use provisions, even these provisions are rarely, if ever, used in New Zealand.²²³

Under section 46 of the Patents Act 1953, a person may apply to the Court for the grant of a compulsory licence where “a market for the patented invention is not being supplied, or is not being supplied on reasonable terms, in New Zealand”. Clearly in order to apply for the grant of a compulsory licence, a potential licensee must have made some attempts to agree a licence with the patent holder. This compulsory licence provision has never been used by a New Zealand Court.²²⁴

Under section 55(1) of the Patents Act:

“any Government Department, and any person authorised in writing by a Government Department, may make, use, exercise and vend any patented invention for the services of the Crown and anything done by virtue of this subsection shall not amount to an infringement of the patent concerned.”

The right to use the patented invention (other than in emergencies) is subject to the Government Department “having first taken all reasonable steps to obtain the consent of the patentee to the use of the patented invention on reasonable terms

²²³ These provisions have never been used, but the fact that they exist likely represents a strong incentive for patent holders to attempt to reach agreement on licenses: King and Tizard, "Memorandum to Cabinet Policy Committee: Report Back with Recommendations and Options for Addressing Genetic Material Patents."

²²⁴ James Packard Love, "Recent Examples of the Use of Compulsory Licences on Patents," (Knowledge Ecology International, 2007) provides international examples of the use of compulsory licensing, particularly in relation to healthcare patents. Interestingly, in response to Myriad's BRCA1/2 patents, France amended its law to allow "ex-officio" licenses for "a) a medicine, a medical device, a medical device for in vitro diagnosis, a related therapeutic product; b) processes for obtaining them, [or] for products necessary in obtaining such medicines or for processes for manufacturing such products c) a diagnostic method ex vivo."

and conditions, and having failed to obtain such consent within a reasonable period of time” (section 58A(3)).

Section 55 is subject to sections 58A to 58C, which:

- outline that the rights under section 55 are not exclusive, may not be assigned otherwise than with the goodwill of the business in which the patented invention is used, and is limited to the supply of the invention predominantly in New Zealand;
- give an interested party the right to apply to the Court to terminate the Crown use where the circumstances that gave rise to the use have ceased and are unlikely to recur;
- require the Crown to inform the patent owner and provide them with any information required;
- require the Crown to pay remuneration as agreed or as set by the Court to the patent holder.

Because of the requirements in both the compulsory licence and Crown use provisions for the licensee and the patent-holder to attempt to agree on a license, these provisions act as a strong incentive to come to an agreement. It is highly likely that GTG would have been briefed on the existence of the Crown use provisions during its negotiations with the Government (and government agencies) and would have taken these provisions into account in agreeing a licence.

The Patents Bill retains both compulsory licences (clauses 159-164) and Crown use provisions (clauses 165-174), both in a very similar if more detailed form. Their retention in new legislation will ensure an ongoing incentive for patentees and potential licensees to come to mutual licensing arrangements without the intervention of the courts or the Crown. Nicol and Nielsen suggest that the administrative procedures provided for in these provisions could be simplified

(e.g. by allowing application to an administrative body rather than a Court), possibly allowing for ease of use.²²⁵ This sentiment is captured in clause 170, which allows for the Court to refer matters relating to a Crown use of an invention to an official referee or arbiter. Arguably it is preferable for licensees and patentees to seek licences or licence fees through the Court system, as this allows patent disputes to be tracked and monitored in a public manner. In addition, patent holders and licensees, if they are genuine in their desire to agree a license, are likely also to have already engaged the services of an arbiter.

8.1.2 Exclusions from patentability

Morality and public policy ('ordre public')

Consistent with the ethical objections to patents on genetic material, it has been argued that patents on genetic material are contrary to morality and public policy and should be excluded from patentability on this basis. Under section 27(2) of the TRIPS convention:

"Members may exclude from patentability, inventions within their territory of the commercial exploitation of which is necessary to protect ordre public or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not merely because the exploitation is prohibited by their law."

Section 17(1) of Patents Act 1953 states:

"(1) If it appears to the Commissioner in the case of any application for a patent that the use of the invention in respect of which the application is

²²⁵ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", p. 238.

made would be contrary to morality, the Commissioner may refuse the application.”

The extent of the use of this section by IPONZ is not clear, as Examiner decisions are not made public. However, hearings decisions are available on the IPONZ website (www.iponz.govt.nz) and this database shows that section 17 has only been at issue three times since 2000. Only two of those decisions are available, and both of these involved the application of the methods of medical treatment exclusion (discussed below). The third decision (in 2007) involved the Wisconsin Alumni Research Foundation (WARF) for its patent applications for “Endothelial cells derived from primate embryonic stem cells” and “Method for generating primate trophoblasts”. The WARF patents on methods for generating embryonic stem cell lines are useful research tools that have been widely patented. It is interesting that these patents have not yet been granted in New Zealand, and those patents that they have applied for have been the subject of an Opposition Hearing under the contrary to morality clause.

The exemption will be retained in the new patents legislation as:

“An invention is not a patentable invention if the commercial exploitation of the invention, so far as claimed in a claim, is contrary to public policy or morality.” (Clause 14)

The proposed exemption is slightly different from the current exemption in that the “commercial exploitation” of a patent rather than simply “use” must be contrary to morality.

While many have argued that this exclusion should be used to decline gene patent and other patent applications, it will now be difficult to do so given that the New Zealand patent office has effectively followed the practice of the USPTO in

allowing living organisms to be patented.²²⁶ This approach is not recommended for types of patents for which patents have already been granted. However, there is a need for IPONZ to take account of and where possible, consult on or seek public input on expansions to its practice or changes in how particular technologies are treated, particularly since “morality” is relatively subjective and arguably something to be drawn from the views of society as a whole. It was on this basis that the Royal Commission on Genetic Modification recommended that a Māori Consultative Committee be established by IPONZ to develop procedures for assessing patent applications and to facilitate consultation with the Māori community as appropriate.²²⁷

Methods of medical treatment

In *The Commissioner of Patents v The Wellcome Foundation Ltd*, the Court of Appeal unanimously held that methods of medical treatment do not meet the requirements for patentability.²²⁸ However, it was later held that methods of medical treatment could no longer be treated as not meeting the requirements for patentability, and to be excluded must be declined on moral or policy grounds.²²⁹ On this basis, IPONZ declines methods of medical treatment patents under section 17 of the Patents Act 1953 as contrary to morality or public policy.²³⁰

²²⁶ See, for example: Imutran Limited, "Modified Biological Material," in <http://www.iponz.govt.nz>, ed. IPONZ (1990)., Institut Pasteur, "Genomic DNA Fragments Containing Regulatory and Coding Sequences for the Beta2-Subunit of the Neuronal Nicotinic Acetylcholine Receptor and Transgenic Animals Made Using These Fragments or Mutated Fragments," in <http://www.iponz.govt.nz>, ed. IPONZ (1995)., Ludwig Institute for Cancer Research, "Transgenic Animal with Recombinant Vascular Endothelial Growth Factor B (Vegf-B) Dna and Uses Thereof," in <http://www.iponz.govt.nz>, ed. IPONZ (1998).

²²⁷ Royal Commission on Genetic Modification, "Report of the Royal Commission on Genetic Modification.", p. 288. The European Society of Human Genetics has taken a similar approach in recommending that the EPO “consider the benefit of having an ethics committee to consider issues of major interest, such as patents applied to genes”: Ayme, Matthijs, and Soini, "Patenting and Licensing in Genetic Testing: Recommendations of the European Society of Human Genetics."

²²⁸ *Commissioner of Patents V. Wellcome Foundation*, FSR 593 (1983).

²²⁹ *Pharmaceutical Management Agency Ltd V. The Commissioner of Patents and Others*, 56/99 (1999).

²³⁰ Intellectual Property Office of New Zealand, "Discussion Handout and Minutes for the Patent Training Session on Section 17 - Methods of Medical Treatment," (released in part under the Official Information Act 1982).

This means applications that include claims which encompass practical surgical methods for diagnosing and treating humans for illness or disease (i.e. such as a surgical procedure or a particular course of medication) are generally declined by IPONZ.²³¹ Allowable methods of treatment include cosmetic treatments, diagnostic methods not requiring surgical techniques, and elective or cosmetic treatments.²³²

The exclusion will be codified in the Patents Bill. Clause 15 states that “diagnostic, therapeutic, or surgical methods for the treatment of human beings are not patentable inventions”. Pharmaceuticals do not fall under the current or proposed exemption.

Some have argued that the exemption should be interpreted to cover the use of diagnostic genetic tests in humans.²³³ However, historically the exemption has only been interpreted to cover the practical application of diagnostic, therapeutic or surgical methods used between a doctor and patient – rather than the scientific tools and methods used to diagnose and treat. For example, many surgical instruments are patented, and these are used in surgery, but they do not encompass a method for treatment of human beings in themselves.²³⁴ Likewise, a genetic test is an aid to diagnosis, rather than a method for diagnosis and treatment in itself. The diagnosis and treatment requires the skill of a medical professional, having at hand all information about the patient, including the results of any genetic test.

²³¹ The situation is somewhat different in the United States. There, medical process patents can be granted, but there is a statutory limit on their enforcement. See A. S. Kesselheim and M. M. Mello, "Medical-Process Patents - Monopolizing the Delivery of Health Care," *New England Journal of Medicine* 355, no. 19 (2006).

²³² Intellectual Property Office of New Zealand, "Discussion Handout and Minutes for the Patent Training Session on Section 17 - Methods of Medical Treatment."

²³³ "Ontario Report to Premiers: Charting New Territory in Healthcare," (2002).

²³⁴ In addition, the patent fees are encompassed in the cost of the surgical instrument itself.

The exclusion from patentability for methods of medical treatment will be specifically retained in new patents legislation, and its drafting means that IPONZ will not have to rely on a ‘contrary to morality’ exclusion:

“Diagnostic, therapeutic, or surgical methods for the treatment of human beings are not patentable inventions.”²³⁵

IPONZ’s interpretation of this clause is unlikely to change significantly. As discussed above, the word “diagnostic” in this context has been interpreted as incorporating the skills and algorithms used by a medical practitioner in diagnosing a patient, having at hand all the information on the patient (including the results of any genetic test).

8.1.3 *Experimental use exemption*

As noted previously, a patent provides an inventor with a time-limited and exclusive right to exclude others from making, using or selling the patented invention.²³⁶ Over time, both in common and civil law jurisdictions, two ‘research’ exemptions²³⁷ to this exclusive right have developed. These are:

- the pure ‘research use’ exemption; and
- the ‘safe harbour’ or ‘springboarding’ exemption, which allows use of an invention for the purposes of satisfying regulatory requirements for bringing that product to market (once the patent has expired).

²³⁵ Ministry of Economic Development, "Draft Patents Bill."

²³⁶ The exposure draft of the new Patents Bill provides a more comprehensive definition of the rights attaching to the grant of a patent: “A patent gives the patentee the exclusive rights, during the term of the patent, to exploit the invention and to authorize another person to exploit the invention.” (clause 17(1)).

²³⁷ The exemption is variously discussed, particularly in US case law, as an ‘exception’, an ‘exemption’ and a ‘defense’ to infringement proceedings. Throughout this chapter I will mostly use “exemption”, simply for consistency.

While their earliest recognition was in case law, more recently, legislation has clarified and in some cases expanded these exemptions. Appendix 6 contains an examination of past and present incarnations of these two exemptions, both overseas and in New Zealand. This section examines the codified experimental use exemption proposed for New Zealand's new Patents Bill in light of the results of this research.

Examining the evidence in support of introduction of a statutory exemption

In its options paper on the exemption, the Ministry of Economic Development noted that it knew of no instances (other than the GTG case) in which researchers have been approached by patent holders for license fees. In support of the introduction of an experimental use exemption, the Ministry argued that, in addition to the uncertainty surrounding the scope of the common law exemption:

- the danger of being sued for infringement may make researchers reluctant to pursue research in particular areas;
- the transaction and licensing costs associated with seeking a license may be unaffordable, particularly if rights are needed for more than one patent; and
- if Australia was to introduce a statutory exemption without an equivalent in New Zealand, Australia may be seen as a more attractive place than New Zealand to do research.

However, the Ministry also noted the dearth of evidence on whether research was actually being hindered due to lack of a statutory exemption in New Zealand. The results of this research suggest that, while there is some uncertainty among researchers as to the scope and application of the current common law exemption:

- GTG is still the only example of infringement proceedings that New Zealand biotechnology organisations have been involved in thus far;
- New Zealand biotechnology research organisations face relatively high transaction costs associated with ensuring freedom to operate (though these costs are not prohibitive and nor are the costs associated with seeking licences); and
- existing patents do occasionally lead to research projects being abandoned, not commenced, reorganized, or reduced in scope.

Six of 14 research organisation respondents confirmed that their organisation had been contacted regarding their potential infringement of a patent, though in all cases the patents concerned were GTG's non-coding DNA patents. Only one of 14 respondents had discontinued research as a result of notification and threat of litigation from a patent holder. Again the patent holder was GTG.

As discussed in section 6.4.1, New Zealand biotechnology research organisations spend considerable resources on patent searches to ensure freedom to operate.²³⁸ Twelve of 15 respondents indicated that they or another person in their organisation conducted regular patent searches. A majority of respondents (11) indicated that patent searching was carried out both in-house and by a patent attorney.

Six of 16 respondents reported licensing-in patented technologies. One quarter of all respondents indicated that they had encountered difficulties in licensing-in patented technologies (with difficulties pertaining to cost, threat of infringement, and unrealistic demands by the patentee). In addition, just over half of research organisation respondents (6 of 11) indicated that they had abandoned licensing-

²³⁸ Some respondents indicated that their patent searches had other purposes, including seeking their own intellectual property, "commercial opportunities", and "assessing the IP situation when a new field opens up".

in negotiations²³⁹ for reasons including the patent holder's unreasonably high expectations of license fees, a failure to agree terms, the researcher having found another technology, and "limits to value". Only one research organisation (of twelve) indicated that they had been refused a licence outright.²⁴⁰ The refusal did not cause the respondent to abandon that line of research.

While research organisations have not been involved in any patent litigation other than the GTG case, the results of the survey suggest that this may in part be due to their careful examination of the current intellectual property landscape, and choice of research projects in relatively unencumbered areas. However, patent searching and difficulties with licensing-in patented technologies represent transaction costs to New Zealand biotechnology organisations. In addition, the results of this research support the contention that some research is not being pursued or has been abandoned because of existing patents.

Six of 15 respondents indicated that they had previously decided not to commence a research programme because of a patent or patents.²⁴¹ Four of 14 respondents indicated that they had changed a research programme (once research had commenced) because a patent blocked access to key research tools or material. When asked to provide detail, comments from respondents indicated that particular patents had limited or changed the scope of research, prevented research from going ahead, or caused the abandonment of the research altogether.

The above evidence therefore supports some the arguments used by the Ministry of Economic Development in support of the introduction of a statutory research exemption. However, it is not clear that a codified research exemption will have

²³⁹ Two responses indicated that the negotiations abandoned were licensing-out negotiations rather than licensing-in.

²⁴⁰ In this case the patent owner was keeping the technology for their own competitive advantage.

²⁴¹ Some respondents noted that identifying such patents prior to commencing research was simply part of the process of due diligence and ensuring freedom to operate.

a marked effect on the issues faced by research organisations as described above.

In the first instance, it is worth considering the effect of a statutory exemption on the GTG case. Essentially, GTG's patents are research tools – the methodology described in the patents is used to determine genetic variation in humans, plants and animals, and is therefore used as a tool for genetic testing and research in these areas. In essence, the proposed exemption allows experimentation on the subject matter of the invention. While I am not privy to the detail of the work being undertaken in the organisations approached, it is likely that the methodology described in the patents was being used as a tool **in** research, rather than the methodology being the subject of the research itself. Where the methodology in the patent was the subject of the research itself (i.e. an attempt to improve upon it or discover more about it), then the researchers could, quite confidently, have undertaken that research without fear of liability, even under the existing common law exemption. Given that the patents were issued in the early 1990s, and the methodology described therein has arguably been known about since at least that time,²⁴² it is difficult to believe that the patents themselves would still be the subject of experimentation.²⁴³ Despite the GTG case being the main impetus for the introduction of the exemption, it is unlikely that an experimental use exemption, codified or uncodified, would have made a huge difference to the scope or outcome of the GTG case.

The introduction of a statutory exemption will undoubtedly provide some clarity and certainty to researchers and patent holders, provided that they are aware of its existence and effect. At the margins it can be speculated that the exemption will allow for more preliminary or 'investigatory' research to take place prior to a company having to choose a particular research path. Such exploratory research

²⁴² Francis Collins et al., "A Patent's Place: Six Contrasting Views on the Noncoding DNA Patents and Business Strategy of Genetic Technologies," (2003).

²⁴³ Notwithstanding, it is worth noting that while experimentation **on** an invention is exempted from infringement liability, a researcher who intends to commercialise an improvement to an invention may need to seek a license from the original patentee.

on patented inventions may open up research possibilities in areas that would otherwise appear overly encumbered. An explicit exemption may therefore have the effect of reducing, to a small extent, the transaction costs faced by research organisations in searching for and assessing relevant patents by allowing for this preliminary research.

However, as shown in the GTG example above, a codified exemption will have only a very minor impact on other difficulties experienced by research organisations in licensing-in technologies and carrying out research. This is because the majority of technologies to be licensed in, particularly in the area of biotechnology, are research tools, and will be used in research rather than being the subject of research.

Conclusion

While there is little evidence of researchers having been threatened by litigation (other than the GTG case), the above evidence does suggest that transaction costs associated with searching for and assessing intellectual property may be hindering research in some areas in the biotechnology industry. It is not evident, however, that codifying a statutory experimental use exemption would have an impact in this regard. It is likely that many of the patents which have prevented or hindered research are patented inventions or methods that were going to be used in research rather than being the subject of research themselves (which the exemption would protect). The GTG case and its use as a partial reason for the introduction of an exemption is a good example of the misconstrued expectations surrounding the codification of a statutory exemption.

On balance however, the introduction of a codified exemption in New Zealand should be seen as a positive development, even if its only function is to bring clarity to an otherwise uncertain common law exemption.

8.1.4 Structural solutions

A number of different kinds of structural solutions to overcoming licensing difficulties have been developed. These include patent clearing houses, patent pools, and formal and informal collaborations and cross-licenses between licensees to increase access to technology. A variety of guidelines on best practices and principles for the licensing of genetic inventions and research tools have also been developed by a number of organisations.²⁴⁴

There are a number of different kinds of patent clearing houses, ranging from those which only provide access to protected information, to technology exchange platforms, right through to more advanced clearing houses which aim to standardise licensing and use of intellectual property. More advanced clearinghouses might operate in a similar manner to a copyright collective – the clearinghouse gains authority from patent holders to license out patent rights, and administers those rights and license terms to those who require them.²⁴⁵ In contrast with patent pools, licensees only take licenses to those patents that they actually need for their research. If enough patent holders participate in the clearing house, a licensee need only negotiate with one ‘administrator’ for access to a number of different patents. However, as Sheremata and Gold note, government pressure may be required to encourage industry to participate in such a mechanism.²⁴⁶

Ebersole et al define a patent pool as “an arrangement in which two or more patent owners agree to license certain patents to one another and/or third parties. ...The pool members should issue nonexclusive licenses to the pooled

²⁴⁴ California Institute of Technology et al., "In the Public Interest: Nine Points to Consider in Licensing University Technology," (2007), National Institutes of Health, "Best Practices for the Licensing of Genomic Inventions.", National Institutes of Health, "Report of the N.I.H. Working Group on Research Tools.", Organisation for Economic Cooperation and Development, "Guidelines for the Licensing of Genetic Inventions," (2006).

²⁴⁵ Lori Sheremata and E. Richard Gold, "Creating a Patent Clearinghouse in Canada: A Solution to Problems of Equity and Access," *Health Law Review* 11, no. 3 (2003).

²⁴⁶ *Ibid.*

patents at reasonable non-discriminatory royalties and allow pool members to offer licenses to one or more of their own pooled patents outside of the pool structure.” However, as noted by Sheremata and Gold, to be effective, patent pools must relate to a single technological platform, which is more difficult in the biotechnology field because there is no one ‘standard’. Hopkins et al found that 25 out of 27 assignees had no pooled DNA patents and the majority (15/26) did not anticipate this changing in the next five years, although six (mainly public sector organizations) did expect to undertake patent pooling in the future. Barriers to patent pooling were raised in subsequent interviews, and included “previous licensing agreements, the need to raise significant revenues to justify maintaining patents, and scepticism over the workability/suitability of pools in molecular genetics, bar key techniques such as PCR.”²⁴⁷

Cambia²⁴⁸ has developed a variation on a patent pool in the form of a ‘Bios-license’, whereby patent-holders and licensees share in a ‘protected commons’ by signing Bios-compliant agreements. At this stage, two technology portfolios, genetic resource indexing technologies and plant enabling technologies, are available under a Bios-license. Under a Bios-compliant agreement, “technology is available royalty-free for use in research or in creating products, by anyone in any country, based on a legally binding agreement to the following elements:

- All the agreements are non-exclusive;
- An owner of technology made available for use under a BIOS-compliant agreement, or an improvement to such technology, may not assert IP rights over that technology or improvement against any other entity that abides by the terms of a BIOS-compliant agreement;
- All licensees covenant to share improvements, making them available for use, even though they may be patented, to all other licensees;

²⁴⁷ Hopkins et al., "The Patenting of Human DNA: Global Trends in Public and Private Sector Activity."

²⁴⁸ <http://www.cambia.org>

- Participants share biosafety data and any other information needed to meet regulatory requirements for use in commercial products.”²⁴⁹

As discussed above, research shows that relative bargaining power can have an outcome on license negotiations. The Biosciences Consortium formed to deal with GTG is a good example of the benefits of collaborating to achieve a common licensing arrangement (or to challenge a patent). Other than the GTG case, my research suggests that there have been no other instances of collaboration used in New Zealand. Interviewees did not mention use of any other structural solutions, though one survey respondent noted their use of a patent searching company in the United States.

It is unlikely that any of the formal structural solutions discussed above (other than collaboration) are in use or have been used by New Zealand biotechnology research organisations. Survey respondents and interview participants did not mention their use. While there is no evidence of widespread use of these structural solutions in New Zealand at this stage, it may be worth bearing them in mind for future use.²⁵⁰ New Zealand research organisations may utilise overseas models currently being trialled, or may look to set up a patent pool or clearinghouse for use by New Zealand researchers. Given that the Biosciences Consortium model was relatively effective in achieving a very low cost license from GTG, New Zealand genetics services and research organisations should look to a similar collaborative model if faced with such patent claims in future.

²⁴⁹ Cambia website, “How do Bios agreements work?”, accessed 1 April 2008, <http://www.bios.net/daisy/bios/g1/2441/69.html>.

²⁵⁰ The European Society on Human Genetics also recommends investigating the use of patent pools and clearinghouses as one mechanism to address concerns arising out of the patenting and licensing of genetic testing: Ayme, Matthijs, and Soini, “Patenting and Licensing in Genetic Testing: Recommendations of the European Society of Human Genetics.”

9 Conclusion

This section re-examines the aims and objectives of this research, draws some conclusions from the research in light of those, and makes recommendations for genetics services providers, researchers and government. Finally, I discuss the limitations of this research and make recommendations for future research.

9.1 The aims and objectives of this research

There has been a reasonable degree of speculation, both academic and governmental, in New Zealand and overseas, as to the potential negative impacts of patents on the biotechnology and genetics services sectors. Much of the speculation is negative, with many commentators arguing that patents, and particularly gene patents, will reduce access to genetic testing and stymie research. Apart from some negative effects on the provision of genetic testing in the United States, overseas research suggests that patents are not having the negative impacts on research originally prophesied, and researchers and biotechnology companies are developing business and research models to take account of increasing numbers of patents and potential license difficulties that may be encountered.

GTG's approach to New Zealand genetics services and biotechnology research organisations brought these issues to the fore. A close examination of the GTG case was undertaken as part of the background to this research. The GTG case study (Appendix Four), quite apart from its utility in making the majority of the GTG information public, is useful as an example of broad patents granted early in the genomics revolution, and for examining the New Zealand government and private sector responses to GTG's claims, and potential lessons for future collaboration by New Zealand biotechnology organisations and genetics services providers. The GTG case also provided a New Zealand-specific counterpoint to

the oft-cited behaviour of Myriad Genetics Inc in its enforcement of the BRCA1/2 patents, and is useful as a comparator in this regard.

Also as background to this research, the IPONZ database was searched for research tool and gene patents, and the result of these searches compared with United States and Australia. These comparisons showed that a number of problematic research tool and gene patents have not been granted in New Zealand.²⁵¹

With that context in mind, my research sought to build a picture of the impacts of patents in the New Zealand genetics services and biotechnology industries. Very little empirical research has been conducted in New Zealand in this area. My research therefore focused on:

- the extent to which genetic services and research organisations in New Zealand are affected by the increasing complexity of the patent landscape;
- whether New Zealand genetic services and research organisations are affected by the particular patents and licensing practices that have been identified as ‘problematic’ overseas; and
- the patenting and licensing practices of New Zealand biotechnology organisations.

The particular issues faced by the New Zealand genetics services sector that were investigated in this research included:

- the extent of patent searching;
- whether patents delay the development and use of genetic tests;
- whether the licensing practices of patentees reduce access to particular tests and the extent of licensing in;

²⁵¹ However, a number of interviewees suggested that this situation may be changing, as many patents are now being filed in New Zealand.

- whether patents increase the costs of tests to laboratories;
- instances of coordination between genetics services to obtain licenses; and
- clinicians' attitudes on the impacts of patents, and particularly gene patents, on genetic testing.

The particular issues faced by the New Zealand biotechnology research sector were also investigated in this research, including:

- the extent of patent searching and assessment and the transaction costs associated with these activities;
- the extent of licensing in and difficulties obtaining access to necessary intellectual property;
- instances of coordination between organisations to obtain licenses;
- the extent of patent ownership and licensing out; and
- attitudes of researchers on the impacts of patents in their field.

This research also investigated the views of those providing services to the genetics services and biotechnology sectors.

This research also took specific account of the incentive effects of patents on research. In particular, these issues were canvassed in follow-up interviews and were addressed peripherally in some survey questions (i.e. in questions on patent ownership, licensing-out, and attitudes towards patents).

9.2 *Conclusions*

In an economy as small as New Zealand's, one might have expected anticommons issues and problematic patenting and licensing practices to have a disproportionately negative effect on both the genetics services and research sectors, resulting in the biotechnology industry finding it more difficult to compete

on an international scale and the genetics services sector hampered in providing a full suite of genetic tests within the New Zealand public health system. Instead I found the opposite: New Zealand's relative isolation and size means that many patents are not being filed or enforced here, and New Zealand genetics services and research organisations are not overly negatively impacted by patent licensing and enforcement issues.

Significantly, background research for this project has shown that many patents identified as 'problematic' overseas have not been filed or are not being enforced in New Zealand. Those patents that have not been filed are not going to affect the biotechnology and genetics services sector in future. It is speculated that those patents that have been granted in New Zealand are not being enforced due to New Zealand's relative isolation and small target market size. The lack of large-scale private genetic testing services may also be discouraging patent holders from enforcing their patents against New Zealand's small public health system. At this stage, these factors are protecting the New Zealand biotechnology and genetics services sectors. However, as discussed below, this situation may be changing.

In the genetics services sector, my research shows that patents are not having an impact at this stage. However, the fact that one New Zealand genetics services provider faced a license and/or royalty request from an overseas patent holder during the course of this research indicates that there is still a need for caution in this area. One can certainly not conclude that GTG was an isolated case. There is a time lag between discovery, filing, granting and enforcement, and a number of patents filed on genetic discoveries in the last few years are now only starting to be enforced. In addition, Cho et al's findings on the impacts of patents on the United States genetic services sector indicate further reason for

vigilance – particularly as the United States is likely to be the first target market prior to a patent being enforced elsewhere.²⁵²

Filing rates at IPONZ show that numbers of patents being filed and granted are increasing slowly over time, also indicating a need for future caution in this area. Interview participants also expressed the view that New Zealand was no longer seen as an uneconomic target market, and with the international patent filing system, it is natural for patents to be applied for and eventually enforced in New Zealand.

Consistent with similar research undertaken within the last decade overseas,²⁵³ these findings support the view that patenting and licensing practices within the biotechnology industry are finding their own equilibrium. New Zealand research organisations do occasionally encounter difficulties in accessing necessary intellectual property, and shy away from fields of research which appear to be overly encumbered. However, on the whole, patents and their related licensing practices do not appear to be having a negative impact on research in New Zealand's biotechnology sector.

One possible explanation for this finding is that New Zealand research organisations appear to expend relatively significant resources searching for and assessing patents. Patent searching and assessment is necessary for research in the biotechnology field. However, many respondents to the survey that was a component of this research expressed frustration that the largest cost in carrying out such assessments was comprised of patent attorney fees. There may be

²⁵² Even during the time it took to do this research, one of the patents which at the start of the research had not been granted here was accepted and granted by the end of the research, indicating that some overseas patent holders are only now starting to turn their attention to other countries and target markets (the patent was Human Genome Sciences patent on the CCR5 receptor: 527126).

²⁵³ Cho et al., "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services.", Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", Straus, Holzappel, and Lindenmeir, *Genetic Inventions and Patent Law: An Empirical Survey of Selected German R&D Institutions*, Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation."

some potential for aggregation of these costs across the sector, or collaboration between companies to reduce patent searching costs where the companies are not in competition.²⁵⁴ It is likely that informal collaborations already occur in this regard, particularly in the public research sector. However, most respondents also acknowledged that patent searches play a large role in ensuring companies have freedom to operate, and can expand into new fields of research when these fields are unencumbered. The searches also ensure that potentially problematic patents are identified and licenses sought at an early stage, thereby reducing the possibility of having to stop or change the direction of research later.²⁵⁵ Obviously, preliminary patent searching also increases the likelihood of research resulting in patentable inventions.

Patents also play an important role in the growth of New Zealand's biotechnology industry, and in that regard there are some positive findings from this research. New Zealand biotechnology companies appear to be competing at an international level in terms of patent ownership in particular, and are gradually working to license out intellectual property to their commercial advantage. Many survey and interview participants noted that patenting was a very expensive process, and many could not afford to patent all inventions coming from discoveries at their institution. However, the process of prioritising inventions for patent protection is natural in any industry, and must also occur in the biotechnology sector. Rigorous analysis of the likelihood of an invention's commercial return is required to ensure that there will be a return on any government and private sector investment.

²⁵⁴ A small number of patent search firms exist, but the business of providing patent searching and assessments is still dominated by patent attorneys, largely because of the need for "authentic authority" – lawyers, and in particular, patent attorneys, are the only people whose professional opinion can be relied upon in making important business decisions. However, much of the searching and assessment work can be done in-house or through these external services, prior to seeking legal advice.

²⁵⁵ Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation." also speculated that this was occurring in the United States and preventing any major licensing difficulties.

The GTG case was a timely and important reminder for New Zealand health and research organisations as to their vulnerability to broad license claims. The lessons learnt in the GTG case about the power of cooperation and sharing resources between organisations should not be lost.

The GTG case also led to a closer examination of New Zealand's patents system during the review of the Patents Act, and will specifically lead to the introduction of a statutory experimental use exemption in New Zealand. While it is unlikely that a statutory experimental use exemption will have much impact on the ability of researchers to use patented research tools and other patented products in research without a license, it will provide clarity and confidence for researchers working in many fields. It will be important to familiarise researchers with the new requirements for patentability, once the Patents Bill has been enacted.

The results of this research also emphasise that New Zealand is heading in the right direction with the overhaul of the Patents Act. The proposed changes will bring New Zealand's patent system in line with its international trading partners, and the introduction of enhanced criteria for patentability and increasing the stringency requirement will increase the quality, strength and durability of patents granted in New Zealand. The introduction of a post-grant opposition scheme will ensure that problematic patents can be re-examined without necessarily having to go through costly litigation. The establishment of a Māori Consultative Committee for IPONZ may play a role in ensuring that societal views are taken into account when IPONZ is examining a new patent type. Given Māori concern around 'bioprospecting'²⁵⁶ and the WAI262²⁵⁷ claim, it seems likely that the Māori Consultative Committee will take a keen interest in biotechnology patenting.

²⁵⁶ See, for example, <http://www.med.govt.nz/upload/51881/hui-minutes-Rotorua.pdf> and Ministry of Economic Development, "Bioprospecting: Harnessing Benefits for New Zealand," (2007).

²⁵⁷ Ngāti Kuri, Ngāti Wai, Te Rarawa, Ngāti Porou, Ngāti Kahungunu and Ngāti Koata claim that the Crown has: "failed to actively protect the exercise of tino rangatiratanga and kaitiakitanga by the claimants over indigenous flora and fauna and other taonga, and also over mātauranga Māori (Māori traditional knowledge); failed to protect the taonga itself; usurped tino rangatiratanga and kaitiakitanga of Māori in respect of flora and fauna and other taonga through the development of policy and the enactment of legislation; and breached the Treaty of Waitangi by agreeing to

9.3 Recommendations

The findings of this research are relatively positive, and therefore the recommendations that follow do not recommend major changes in any area.

In the genetics services sector, prior to carrying out this research and with the GTG case in mind, one might have recommended proactive patent searching as a way of mitigating legal risk. However, given that there are currently very few relevant patents filed and/or granted in New Zealand, and enforcement by patent holders is relatively uncommon at this stage, proactive patent searching is not recommended. Patent searching by genetics services is also likely to be alarmist, and its costs are likely to outweigh any potential benefits. As also noted in section 5.4 above, there is an argument that lack of awareness of an existing patent may possibly protect genetics services to some extent if they are sued for past damages.²⁵⁸ When or if genetics services are faced by another claim for royalties or license fees, consideration should be given to coordinating across the sector to negotiate a New Zealand-wide license, as occurred in the GTG case.

For the biotechnology sector, again the lessons of coordination learned through the GTG case should not be forgotten. Licenses for research tools that are common across many fields of technology (such as PCR and GTG's patents) can be negotiated on a group basis, and some consideration should be given to this possibility if organisations are approached for similar patent licenses in future. New Zealand's small size and flexibility means that it is ideally placed to increase its bargaining power through collaborations across organisations in licensing negotiations.

various international agreements and obligations that affect indigenous flora and fauna and intellectual property rights and rights to other taonga." See Ministry of Economic Development, "Information Sheet: Treaty of Waitangi Claim Wai 262," (2007).

²⁵⁸ Patents Act, section 71.

As noted above, there may be some savings to be made where patent searching obligations can be aggregated or coordinated – particularly across departments or institutions. While this may not always be practical because of the specialised subject areas, it is worth investigating – even if it just results in a discounted hourly rate from a patent attorney for their services. Within universities, it may also be possible to use the knowledge and expertise of law faculty staff and students, prior to seeking formal legal advice.²⁵⁹ It would seem that patent searches and assessments in particular areas (i.e. to ensure freedom to operate) would be ideal assignments for budding patent lawyers in law faculties across New Zealand.

Finally, when the new Patents Bill is enacted, researchers and managers alike will need to upskill on the requirements for patentability under the new Act, and will need to become familiar with the opposition and other proceedings available. Familiarity with the application and interpretation of the statutory experimental use exemption will also be required.

It will therefore be important for the Government, upon the enactment of the Patents Bill, to provide information to researchers on the new Patents Act and the requirements for patentability. In particular, information on the new experimental use exemption will be particularly useful. The Ministry of Economic Development should monitor the application and use of the exemption to ensure that it is meeting the original intentions for its introduction. Again, the lessons of coordination learnt through the GTG case should not be lost to the government sector either. Government involvement and funding in the GTG case was crucial in assisting the Biosciences Consortium to assess the patents and to undertake negotiations with full Government support. Government agencies should consider offering support in future should a similar case arise.

²⁵⁹ Most universities in New Zealand carrying out biotechnology research also have schools of law.

Currently, the Crown research institutes report on patents and licenses granted each year in their annual reports, and it is likely that many private research companies do also. In addition, the Foundation for Research, Science and Technology occasionally collates and reports on patents arising out of FRST-funded research. However, there is no single place where intellectual property ownership for both the public and private sectors is collected, monitored and celebrated. While one can see New Zealand's total patent ownership in the area of biotechnology in the OECD *Compendium of Patent Statistics*, it would be useful to have this data collected and analysed in New Zealand, along with other information such as licensing arrangements entered into, whether the patents were New Zealand or overseas patents, and revenues collected from licenses. Consideration could be given to adding these questions to the Biotechnology Survey, when it is next carried out by Statistics New Zealand in 2009.

9.4 *Limitations*

The main limitation of this research is the relatively low response rate, particularly for the biotechnology research sector. There are a number of potential reasons for the low response rate (and the high partial complete rate). While the personal follow-up emails elicited further survey participation, the emails also helped to elicit some of the reasons why people were not participating in the survey, or were only partially completing the survey.

It is likely that a number of participants considered that the survey was not relevant to them or the activities of their organisation. Salience of an issue²⁶⁰ to a sample population has been shown to have a strong positive correlation with response rate in email surveys.²⁶¹ For example, the director of a research institute indicated in a telephone conversation with the researcher that his

²⁶⁰ Salience has been defined as the association of importance and/or timeliness with a particular topic. See C.L. Martin, "The Impact of Topic Interest on Mail Survey Response Behaviour," *Journal of the Market Research Society* 36, no. 4 (1994).

²⁶¹ Kim Bartel Sheehan and Sally J. McMillan, "Response Variation in Email Surveys: An Exploration," *Journal of Advertising Research* 39, no. 4 (1999).

institute neither sought nor owned patents, and their research had never been affected by existing patents. He therefore considered the survey to be irrelevant to the activities of his organisation, and did not wish to take part in it. It is likely that a number of other people in the sample group also had a similar reaction.

The online format of the survey may have discouraged people from participating. Participants were given the option of emailing to request a paper copy of the survey, but only four respondents did so (and all four paper copies were returned by respondents). That said, the 'depersonalising' effect of email may have played a role in discouraging people from participating in the survey. More people may have been inclined to fill out a paper copy – especially since a paper copy can be circulated throughout an organisation to get responses from different people affected (for a coherent organisational response).

It is also possible that because the first invitation to participate was a 'batched' email, blind copied to all participants in two separate emails, either the sending email system or receiving email system could have registered the invitation as 'junk' or spam, and it may have been undelivered to many in the sample group. However, the follow-up reminder emails were sent on an individual basis, and so should not have been blocked as spam.

As noted above, people only partially completing the survey may have considered it to be irrelevant to the activities of their organisation, particularly after answering a few questions to see what it was about.²⁶² Alternately, the survey may have been too long (the average completion time was approximately 15-20 minutes for most respondents).²⁶³ The survey gave participants the option of 'pausing' the survey, and having a link emailed to them to get back to that point in the survey. In at least one case, the email with the link was directed into

²⁶² The highest drop-out rate was after the first 5-6 questions.

²⁶³ The online survey software recorded the time the respondent started the survey and the time that they completed it.

a participant's junk mail, so that to them it was lost and they were not able to complete the rest of the survey.²⁶⁴ This may have happened in other cases.

As noted above, salience of an issue is an important factor in determining response rate.²⁶⁵ It is therefore speculated that there may be some degree of apathy among researchers and providers of clinical genetic testing services to these issues in New Zealand, mainly because they are not (or not yet) affected by them. This lack of interest can also be seen in the response received by the Ministry of Economic Development to its consultation on a research exemption in the New Zealand Patents Act, in which only 10 submissions were received, the majority of which were from law firms.

Another limitation of this research is its ultimately qualitative nature. As much as possible the survey questions were unbiased and were not written in a way that might suggest or anticipate a negative response. However, in a survey such as this, it must be grounded in its own theory, thereby to some extent identifying the issues with which I was ultimately concerned, and possibly raising awareness of these issues among respondents.

As with any written survey, it is also possible for questions to be misinterpreted. I did not see any evidence of question misinterpretation in the written answers given by respondents. In addition, the risk of question misinterpretation was minimised by testing the survey prior to distribution with a clinical geneticist and a researcher.

²⁶⁴ Although in this particular case, the participant was interested enough in completing the survey to email the researcher to find out where the email might have gone to or how to get back to that point in the survey. The participant was able to complete the survey after finding the email in their junk emails.

²⁶⁵ Martin, "The Impact of Topic Interest on Mail Survey Response Behaviour.", Sheehan and McMillan, "Response Variation in Email Surveys: An Exploration."

9.5 Recommendations for future research

As this was a relatively small survey, there is scope for expansion of the survey in many areas. First, and as an upshot of the cautionary note sounded in the conclusion to this research, the impacts of patents on the genetics services and biotechnology sectors should continue to be monitored, particularly as more patents are granted in New Zealand and as patent holders expand their patent licensing areas to include Australasia.

One notable area into which further research is justified is the impact of patents in incentivising innovation and research in New Zealand, a subject which was not explicitly investigated in this research. This is an important area for future research, particularly if the New Zealand Government continues to emphasise the importance of biotechnology in stimulating New Zealand's economic growth.

There appear to be high transaction costs associated with searching for and assessing relevant patents in the New Zealand biotechnology research sector. Further research on ideas for collaboration and reducing these transaction costs could be investigated.

Once the new Patents Bill has been enacted, there will be scope for further research in the area of biotechnology research, genetic testing services and patent ownership. In particular, it would be useful to chart the legal development of the statutory experimental use exemption, and its application by researchers in various fields of research. The application of the new patentability criteria and the explicit statutory exclusions by IPONZ to various inventions might also be charted.

If direct to consumer advertising of genetic testing becomes more prevalent, its impacts both on patients and the public health sector could be considered and measured. Finally, offering genetic testing via the internet appears likely to

become commonplace. There are many issues associated with online genetic testing, and these could be further explored in a New Zealand context. As online genetic testing becomes more common in New Zealand, research on the uptake and impact of online genetic testing on the New Zealand public health sector would be useful.

As noted above, there are particular issues in New Zealand for Māori relating to the ownership of intellectual property in traditional knowledge, and flora and fauna. Further research and thinking needs to occur to ensure that Maori concerns relating to intellectual property over biotechnology inventions, are articulated and widely discussed, and can be fed into the operation of the Māori Consultative Committee.

Finally, this research uncovered a dire lack of cohesion and coordination in the New Zealand genetics services sector. For a country of only 4 million people, "the size of a large city",²⁶⁶ there would be major financial and administrative savings to the health sector if genetics services were funded and coordinated nationally, as recommended by the National Health Committee in 2003.²⁶⁷ There is a clear need for further research and policy work in this area.

²⁶⁶ As one geneticist stated.

²⁶⁷ National Advisory Committee on Health and Disability, "Molecular Genetic Testing in New Zealand."

Bibliography

- Advisory Council on Intellectual Property. "Patents and Experimental Use." 2005.
———. "Patents and Experimental Use: Options Paper." 2004.
- Akro Agate Co. V. Master Marble Co.*, 18 F. Supp. 305 (1937).
- American College of Medicine Board of Directors. "A.C.M.G. Statement on Direct-to-Consumer Genetic Testing." *Genetics in Medicine* 6, no. 1 (2004): 60.
- Arora, Ashish, Marco Ceccagnoli, and Wesley M. Cohen. "R&D and the Patent Premium." NBER Working Paper No. W9431, January 2003.
- Arrow, KJ. "The Economic Implication of Learning-by-Doing." *Review of Economic Studies* 50 (1962): 155-73.
- Association of University Technology Managers. *F.Y.2005: A.U.T.M. U.S. Licensing Survey*, 2007.
- Australian Law Reform Commission. "Genes and Ingenuity: Gene Patenting and Human Health." Sydney, NSW, 2004.
- Ayme, S, G Matthijs, and S Soini. "Patenting and Licensing in Genetic Testing: Recommendations of the European Society of Human Genetics." *European Journal of Human Genetics* 16 (2008): 405-11.
- Baldwin, Bob. "New Laws Ensure More Freedom for Australian Innovators." edited by IP Australia: Parliamentary Secretary to the Minister for Industry, Tourism and Resources, 6 August 2007.
- Bayer V Schein Pharm. Inc.*, 301 F.3d 1306 (2002).
- BC Ministry of Health Services. "Federal Leadership Urged as Genetic Testing Resumes." 14 February 2003.
- Blumenthal, D., E. G. Campbell, M. S. Anderson, N. Causino, and K. S. Louise. "Withholding Research Results in Academic Life Science. Evidence from a National Survey of Faculty." *Journal of the American Medical Association* 277, no. 15 (1997): 1224-28.
- Bonsack Machinery Co. V. Underwood*, 37 F. 206 (1896).

- Bunk, Steve. "Researchers Feel Threatened by Disease Gene Patents." *The Scientist* 13, no. 20 (1999): 7.
- Business Wire. "Oncorimed Issued Second Patent for B.R.C.A.1 Gene." <http://www.findarticles.com>, 28 May 1998.
- Bussieres, Sylvie. 2000. Canada Welcomes W.T.O. Ruling on E.U. Challenge of Canada's Pharmaceutical Patent Regime. In, http://w01.international.gc.ca/minpub/PublicationContentOnly.asp?publication_id=377555&Language=E&MODE=CONTENTONLY&Local=False. (accessed 17 August 2007).
- California Institute of Technology, Cornell University, Harvard University, Massachusetts Institute of Technology, Stanford University, University of California, University of Illinois, University of Washington, Wisconsin Alumni Research Foundation, Yale University, and Association of American Medical Colleges. "In the Public Interest: Nine Points to Consider in Licensing University Technology." 2007.
- Campbell, Eric G., Brian R. Clarridge, Manjusha Gokhale, Lauren Birenbaum, Stephen Hilgartner, Neil A. Holtzman, and David Blumenthal. "Data Withholding in Academic Genetics." *Journal of the American Medical Association* 287, no. 4 (2002): 473-80.
- Caruso, Andrew J. "The Experimental Use Exception: An Experimentalist's View." *Albany Law Journal of Science & Technology* 14 (2003-2004): 215-44.
- Caulfield, Timothy. "Genetic Testing, Ethical Concerns, and the Role of Patent Law." *Clinical Genetics* 57, no. 5 (2000): 370-75.
- . "Policy Conflicts: Gene Patents and Health Care in Canada." *Community Genetics* 8, no. 4 (2005): 223-27.
- Caulfield, Timothy, Tania Bubela, and C J Murdoch. "Myriad and the Mass Media: The Covering of a Gene Patent Controversy." *Genetics in Medicine* 9, no. 12 (2007): 850-55.

Caulfield, Timothy, Robert M. Cook-Deegan, F. Scott Kieff, and John P. Walsh. "Evidence and Anecdotes: An Analysis of Human Gene Patenting Controversies." *Nat Biotech* 24, no. 9 (2006): 1091.

Centre for Intellectual Property and the Health Law Institute. "The Research or Experimental Use Exemption: A Comparative Analysis." *Chesterfield V. United States*, 159 F. Supp. 371 (1958).

Cho, Mildred K., Samantha Illangasekare, Meredith A. Weaver, Debra G. B. Leonard, and Jon F. Merz. "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services." *Journal of Molecular Diagnostics* 5, no. 1 (2003): 3-8.

Cohen, Wesley J., Richard R. Nelson, and John P. Walsh. "Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)." Carnegie-Mellon University, 2000.

Collins, Francis, Charles Cantor, Kate H. Murashige, Robert Cook-Deegan, Beth Arnold, and Barbara Ruskin. "A Patent's Place: Six Contrasting Views on the Noncoding DNA Patents and Business Strategy of Genetic Technologies." 2003.

Commissioner of Patents V. Wellcome Foundation, FSR 593 (1983).

Community Action. "Ontario Challenges Drug Patent - Offers Its Own Genetic Testing for Breast Cancer." Find Articles, 20 January 2003.

Cornish, W R, M Llewelyn, and M Adcock. "Intellectual Property Rights and Genetics: A Study into the Impact and Management of Intellectual Property Rights within the Healthcare Sector." Public Health Genetics Unit, Cambridge Knowledge Park, 2003.

Dastgheib-Vinarov, Sara. "A Higher Nonobviousness Standard for Gene Patents: Protecting Biomedical Research from the Big Chill." *Marquette Intellectual Property Law Review* 4 (2000): 143.

Davies, Kevin. "Malcolm in the Middle." Bio-IT World, 2003.

Davies, Kevin, and Mervyn Jacobson. "Conversation with Mervyn Jacobson: Playing by Aussie Rules." Bio-IT World, 2003.

Deuterium Corp. V. United States, 19 Cl. Ct. 624 (1990).

Deuterium Corp. V. United States, 14 U.S.P.Q. 2d 1636 (1976).

Diamond, Commissioner of Patents and Trademarks V. Chakrabarty, 447 U.S. 303 (1980).

Dixon, Joanne. 2008.

Dugan V. Lear Avia, 55 F. Supp. 223 (1944).

Dunlop Pneumatic Tyre Co V British and Colonial Motor Car Co Ltd, 18 RPC 313 (1901).

Dutfield, Graeme. "DNA Patenting: Implications for Public Health Research." *Bulletin of the World Health Organisation* 84, no. 5 (2006): 388-92.

Eggertson, Laura. "Ontario Defies U.S. Firm's Genetic Patent, Continues Cancer Testing." *Canadian Medical Association Journal* 166, no. 4 (2002): 494.

Eisenberg, Rebecca S. "Structure and Function in Gene Patenting." *Nature Genetics* 15, no. 2 (1997): 12-130.

Eisenberg, Rebecca S., Richard D. Nelson, Roberto Mazzoleni, Stephen Hilgartner, Gerald Rubin, Lita Nelson, Leon Rosenberg, Tom D'Alonzo, and Harold Varmus. "Intellectual Property Rights and Research Tools in Molecular Biology." Paper presented at the Workshop held at the National Academy of Sciences, 15-16 February 1996, Washington DC 1996.

Embrex Inc V. Service Engineering Corp., 216 F. 3d 1343 (2000).

Ernst & Young. "Beyond Borders: Global Biotechnology Report 2006." In *Global Biotechnology Report*, 2006.

Eurek, Sarah E. "Hatch-Waxman Reform and Accelerated Market Entry of Generic Drugs: Is Faster Necessarily Better?" *Duke Law & Technology Review* 18 (2003).

Finney V. United States, 178 U.S.P.Q. 235 (1973).

Foundation for Research, Science and Technology. "Protecting and Managing Intellectual Property: Patenting Decisions of Publicly Funded Research Providers." 2004.

Four Corners. "Patently a Problem: Transcript of Television Documentary." Four Corners, 2003.

Frearson V Loe, 9 ChD. 48 (1878).

- Futreal, Phillip Andrew, Richard Francis Wooster, Alan Ashworth, and Michael Rudolf Stratton. "Materials and Methods Relating to the Identification and Sequencing of the B.R.C.A.2 Cancer Susceptibility Gene and Uses Thereof." In <http://www.uspto.gov>, edited by United States Patent and Trademarks Office. United States of America: Duke University and Cancer Research Campaign Technology Ltd, 2002.
- Garforth, Kathryn. "Health Care and Access to Patented Technologies." *Health Law Journal* 13 (2005): 77-97.
- Genetic Technologies Ltd. "Issued Licenses." updated 21 February 2007.
- . "A Report to Shareholders: Genetic Technologies Ltd Obtains Retraction of Wrong Statements by the Royal College of Pathologists of Australasia." <http://www.gtg.com.au/index.asp?menuid=060.070.130.010&artid=98>, 2003.
- Gottlieb, Robert. "Our Cut on DNA Research." *The Australian* 2003, 27-27.
- . "U.S. Genetics Win a Shot in the Arm." *The Australian* 2004.
- Hassett, Warren. Personal communication by email, 30 November 2007.
- Heath, Alison. "Preparing for the Genetic Revolution - the Effect of Gene Patents on Healthcare and Research and the Need for Reform." *Canterbury Law Review* 11 (2005): 59-90.
- Heller, Michael A., and Rebecca S. Eisenberg. "Can Patents Deter Innovation? The Anticommons in Biomedical Research." *Science* 280, no. 5364 (1998): 698-701.
- Henderson, Mark. "Handle with Care: Genetic Tests Are Risky, and I've Got Proof." *Times Online*, 1 March 2008.
- Henry, Michelle R., Mildred K. Cho, Meredith A. Weaver, and Jon F. Merz. "DNA Patenting and Licensing." *Science* 297 (2002): 1279.
- . "A Pilot Survey on the Licensing of DNA Inventions." *Journal of Law, Medicine and Ethics* 31, no. 3 (2003): 442-49.
- Hill, Ruth. "Internet Gene Testing Just 'Health Horoscopes'." 2008.
- Hopkins, Michael M., Surya Mahdi, Sandy M. Thomas, and Parimal Patel. "The Patenting of Human DNA: Global Trends in Public and Private Sector

- Activity." Brighton, East Sussex: SPRU, Science and Technology Policy Research, University of Sussex, 2006.
- Hughes, Sally Smith. "Making Dollars out of DNA: The First Major Patent in Biotechnology and the Commercialization of Molecular Biology, 1974-1980." *Isis* 92, no. 3 (2001): 541.
- Human Genetics Commission. "The Supply of Genetic Tests Directly to the Public: A Consultation Document." 2002.
- Human Genetics Society of Australasia. "DNA Diagnosis of Genetic Disorders in Australasia." January 2007.
- Human Genome Sciences Inc. "Annual Report 2005." Human Genome Sciences Inc, 2005.
- Imutran Limited. "Modified Biological Material." In <http://www.iponz.govt.nz>, edited by IPONZ, 1990.
- In Re Gabapentin Patent*, (2007).
- Institut Curie. "Against Myriad Genetics' Monopoly on Tests for Predisposition to Breast and Ovarian Cancer Associated with the B.R.C.A.1 Gene." *GENET* (2002).
- . "L'office Européen Maintient Le Brevet Sur Le Gène Brca2 Réduit À Une Mutation Particulière Et Sans Effet Bloquant Sur L'activité Des Laboratoires Européens." <http://www.curie.fr/upload/presse/brca2-myriad-6-juil-05.pdf>; Institut Curie, 2005.
- Institut Pasteur. "Genomic DNA Fragments Containing Regulatory and Coding Sequences for the Beta2-Subunit of the Neuronal Nicotinic Acetylcholine Receptor and Transgenic Animals Made Using These Fragments or Mutated Fragments." In <http://www.iponz.govt.nz>, edited by IPONZ, 1995.
- Intellectual Property Office of New Zealand. "Discussion Handout and Minutes for the Patent Training Session on Section 17 - Methods of Medical Treatment." released in part under the Official Information Act 1982.
- . "Introduction to Patents." Ministry of Economic Development, 2005.
- . "Report of the Commissioner of Patents, Trade Marks and Designs to the Minister of Commerce for the Year Ended 30 June 2006." 2006.

- IP Australia. "Australian Government Response to the Advisory Council on Intellectual Property Report Patents and Experimental Use." 2007.
- Jan Fagerberg, David C. Mowery, Richard R. Nelson. *The Oxford Handbook of Innovation*. Oxford: Oxford University Press, 2005.
- Jensen, Kyle, and Fiona Murray. "Intellectual Property Landscape of the Human Genome." *Science* 310, no. 5746 (2005): 239-40.
- Johnston, Josephine. "Health Related Academic Technology Transfer: Rethinking Patenting and Licensing Practices." *International Journal of Biotechnology Law* 9, no. 2 (2007): 156-71.
- Johnston, Josephine, and Angela A. Wasunna. "Patents, Biomedical Research and Treatments: Examining Concerns, Canvassing Solutions." *Hastings Centre Report* 37, no. 1 (2007): S1-S36.
- Johnston, Martin. "Costly Genetic Tests for Cancer Worry Specialists." *New Zealand Herald*, 4 March 2005.
- Karp, Jordan P. "Experimental Use as Patent Infringement: The Impropriety of a Broad Exception." *The Yale Law Journal* 100, no. 7 (1991): 2169-88.
- Kesselheim, A. S., and M. M. Mello. "Medical-Process Patents - Monopolizing the Delivery of Health Care." *New England Journal of Medicine* 355, no. 19 (2006): 2036-41.
- King, Annette. "Report Back to Cabinet Policy Committee on the Fiscal Risks of the Licensing of Genetic Material Patents in the Health Sector." released in part under the Official Information Act 1982, 2005.
- King, Annette, and Judith Tizard. "Implications of the Granting of Patents over Genetic Material." 2003.
- . "Memorandum to Cabinet Policy Committee: Report Back with Recommendations and Options for Addressing Genetic Material Patents." 2004.
- Laws of New Zealand. "Patents and Inventions Vol I 46." Lexis Nexis NZ Ltd, stated as at 1 March 2007.

- LEK Consulting. "New Zealand Biotechnology Industry Growth Report." edited by Ministry of Research Science and Technology, New Zealand Trade and Enterprise and NZBio: LEK, 2006.
- Leonard, Debra G. B. "Gene Patents: A Physician's Perspective." 2004.
- Leute, Kirsten. "Patenting and Licensing of University-Based Genetic Inventions - a View from Experience at Stanford University's Office of Technology Transfer." *Community Genetics* 8, no. 4 (2005): 217-22.
- Lévêque, François, and Yann Ménière. "Patents and Innovation: Friends or Foes?" In *Law and Technology Scholarship*, edited by Berkeley Center for Law and Technology. Berkeley: eScholarship Repository, University of California, 2007.
- Levin, Richard, Alvin Klevorick, Richard R. Nelson, and Sidney Winter. "Appropriating the Returns from Industrial Research and Development." *Brookings Papers on Economic Activity: Microeconomics* (1987): 783-820.
- Lilly Icos Llc V. Pfizer Limited*, BAILII (2000).
- Little, Peter. "Letters: G.T.G.'S Inventions Concerning 'Junk' DNA." Bio-IT World, 2003.
- Love, James Packard. "Recent Examples of the Use of Compulsory Licences on Patents." Knowledge Ecology International, 2007.
- Lowe, Derek. "In the Pipeline: Ariad's Day in Court." *Corante Blog* (2006).
- Ludwig Institute for Cancer Research. "Transgenic Animal with Recombinant Vascular Endothelial Growth Factor B (Vegf-B) Dna and Uses Thereof." In <http://www.iponz.govt.nz>, edited by IPONZ, 1998.
- Madey V. Duke*, 307 F. 3d 1351 (2002).
- Mansfield, Edwin. "Academic Research and Industrial Innovation." *Research Policy* 20 (1991): 1-12.
- . "Patents and Innovation: An Empirical Study." *Management Science* 32, no. 2 (1986): 173-81.
- Marshall, Eliot. "Gene Patents: Patent on H.I.V. Receptor Provokes an Outcry." *Science* 287, no. 5457 (2000): 1375-77.

- Martin, C.L. "The Impact of Topic Interest on Mail Survey Response Behaviour." *Journal of the Market Research Society* 36, no. 4 (1994): 327-37.
- McGee, G. "Gene Patents Can Be Ethical." *Cambridge Quarterly of Healthcare Ethics* 7 (1998): 417-21.
- McNabb, Denise. "Health Boards Deny Gene Test Claims." *The Independent* 2005, 1-2.
- Merz, Jon F., and Mildred K. Cho. "What Are Gene Patents and Why Are People Worried About Them?" *Community Genetics* 8 (2005): 203-08.
- Merz, Jon F., Mildred K. Cho, Madeline J. Robertson, and Debra G. B. Leonard. "Disease Gene Patenting Is a Bad Innovation." *Molecular Diagnosis* 2, no. 4 (1997): 299-304.
- Merz, Jon F., Antigone G. Kriss, Debra G. B. Leonard, and Mildred K. Cho. "Diagnostic Testing Fails the Test - the Pitfalls of Patents Are Illustrated by the Case of Haemochromatosis." *Nature* 415, no. 6872 (2002): 577-79.
- Miller, Jennifer. "Sealing the Coffin on the Experimental Use Exception." *Duke Law & Technology Review* 12 (2003).
- Ministry of Economic Development. "Bioprospecting: Harnessing Benefits for New Zealand." 2007.
- . "Draft Patents Bill." 2004.
- . "An Experimental Use Exception for New Zealand's Patent Legislation: An Options Paper." February 2006.
- . "The Growth and Innovation Framework Sector Taskforces: Progress with Implementation - 2005 Report." 2005.
- . "Information Sheet: Treaty of Waitangi Claim Wai 262." 2007.
- Ministry of Health. "Cabinet Paper Pol (05) 142: Auckland District Health Board Litigation against Genetic Technologies Limited: The Broader Public Interest." released in part under the Official Information Act 1982, 2005.
- . "Genetic Technologies Limited (G.T.G.) Patent Infringement Claim." released in part under the Official Information Act 1982, 2003.
- . "Genetic Technologies Ltd (G.T.G.) Patents - Update on Proposed Litigation." released in part under the Official Information Act 1982, 2004.

- . "Preliminary Advice on Effect of Gene Patents on Genetic Testing Services for Breast Cancer and Other Conditions." obtained under the Official Information Act 1982, 6 November 2002.
- Ministry of Research Science and Technology. "The Biotechnology Research Landscape in New Zealand." 2006.
- . "New Zealand Biotechnology Strategy." Government Press, 2003.
- . "Roadmaps for Science: Biotechnology Research." 2007.
- Molins & Molins Machine Co Ltd V Industrial Machine Co Ltd*, 54 RPC 94 (1936).
- Monsanto Co V Stauffer Chemical Co*, 1 TCLR 129 (1984).
- Morgan, Sonya, Deborah McLeod, Alexa Kidd, and Barbara Langford. "Genetic Testing in New Zealand: The Role of the General Practitioner." *New Zealand Medical Journal* 117, no. 1206 (2004): 1178-89.
- Mueller, Janice M. "No "Dilettante Affair": Rethinking the Experimental Use Exception to Patent Infringement for Biomedical Research Tools." *Washington Law Review* 76, no. 5 (2001): 1-66.
- Myriad Genetics Inc. "Myriad Genetics Collaborates with Astrazeneca on Phase 2 Trials." 2007.
- . "Myriad Genetics Launches Molecular Diagnostic Testing in Canada." 9 March 2000.
- National Advisory Committee on Health and Disability. "Molecular Genetic Testing in New Zealand." Ministry of Health, 2003.
- National Institutes of Health. "Best Practices for the Licensing of Genomic Inventions." *Federal Register* 69, no. 223 (2005): 67747-48.
- . "Report of the N.I.H. Working Group on Research Tools." edited by National Institutes of Health, 1998.
- Nicol, Dianne. "Balancing Innovation and Access to Healthcare through the Patent System - an Australian Perspective." *Community Genetics*, no. 8 (2005): 228-34.
- Nicol, Dianne, and Jane Nielsen. "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry." Hobart, Tasmania: Centre for Law and Genetics, 2003.

- Northill Co. V. Danforth*, 51 F. Supp. 928 (1942).
- Nottenburg, C., and J. Sharples. "Analysis of "Junk DNA" Patents: Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes." 2004.
- Nuffield Council on Bioethics. "The Ethics of Patenting DNA: A Discussion Paper." 2002.
- O'Neill, Graeme. "G.T.G. Celebrates Win over Applera." In *Australian Biotechnology News*: Bio-ITWorld.com, 2005.
- Office of the Prime Minister. "Growing an Innovative New Zealand." edited by Office of the Prime Minister, 2002.
- Oldham, Paul. "Global Status and Trends in Intellectual Property Claims: Genomics, Proteomics and Biotechnology." United Kingdom: Centre for Economic and Social Aspects of Genomics (CESAGen), 2004.
- "Ontario Report to Premiers: Charting New Territory in Healthcare." 2002.
- Organisation for Economic Cooperation and Development. "Compendium of Patent Statistics." 2006.
- . "Compendium of Patent Statistics." 2007.
- . "Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies." 2002.
- . "Guidelines for the Licensing of Genetic Inventions." 2006.
- . *O.E.C.D. Science, Technology and Industry Scoreboard 2007: Innovation and Performance in the Global Economy*, 2007.
- . "Patents and Innovation: Trends and Policy Challenges." 2004.
- Paradise, Jordan, Lori Andrews, and Timothy Holbrook. "Patents on Human Genes: An Analysis of Scope and Claims." *Science* 307, no. 5715 (2005): 1566-67.
- Pfizer Corp V Ministry of Health*, RPC 261 (1965).
- Pharmaceutical Management Agency Ltd V. The Commissioner of Patents and Others*, 56/99 (1999).
- Pharmafocus. "Pfizer Sues Struggling G.S.K. Over Viagra Patent." 1 November 2002.

Pitcairn V. United States, 547 F. 2d 1106 (1976).

Pollack, Andrew. "Lilly Loses Patent Lawsuit to Ariad, M.I.T., Harvard Drug Company to Pay \$65m for Infringing Patent Covering Protein Discovered in Part by M.I.T. Researchers." *The Tech Online* 126, no. 24 (2006).

Pratley, Chris. "Defensive Patenting." 2004.

Pressman, Lori, Richard Burgess, Robert M. Cook-Deegan, Stephen J. McCormack, Io Nami-Wolk, Melissa Soucy, and LeRoy Walters. "The Licensing of DNA Patents by Us Academic Institutions: An Empirical Survey." *Nat Biotech* 24, no. 1 (2006): 31.

Proctor V Bayley & Son, 6 RPC 106 (1888).

Ragg, Meighan. 2008.

Resnik, David B. *Owning the Genome: A Moral Analysis of DNA Patenting*. New York: State University of New York Press, 2004.

Rimmer, M. "Myriad Genetics: Patent Law and Genetic Testing." *European Intellectual Property Review* 25, no. 1 (2003): 20-33.

Roche. "Pharmacogenomics: Genes and Drug Response." http://www.roche.com/pages/facets/22/pharmacogen_e.pdf.

Roche Pharmaceuticals. "News Release: \$100,000 for H.E.R.2 Breast Cancer Testing." 2005.

Roche Products Inc V. Bolar Pharm. Co., 733 F. 2d 858 (1984).

Roche Products Inc V. Bolar Pharm. Co., 221 USPQ 937 (1984).

Royal Commission on Genetic Modification. "Report of the Royal Commission on Genetic Modification." edited by Ministry for the Environment, 2002.

Ruth V. Stearns-Roger Manufacturing Co, 13 F. Supp. 697 (1935).

Sarfati, Diana. "Some Practical Aspects of Genetic Testing in New Zealand: A Report for the National Health Committee." 2002.

Sawin V. Guild, 21 F. Cas. 554 (1813).

Scherer, Frederick M. "The Economics of Human Gene Patents." *Academic Medicine* 77, no. 12 (2002): 1348-67.

Schissel, Anna, Jon F. Merz, and Mildred K. Cho. "Survey Confirms Fears About Licensing of Genetic Tests." *Nature* 402, no. 6758 (1999): 118.

- Scotchmer, Suzanne. "Standing on the Shoulders of Giants: Cumulative Research and Patent Law." *Journal of Economic Perspectives* 5, no. 1 (1991): 29-41.
- Scott, Anne, and Rosemary Du Plessis. "Redefining a Technology: Public and Private Genetic Testing in New Zealand." Paper presented at the Medicine and the Body Politic, University of Brighton, United Kingdom, 21-22 September 2006.
- Sevilla, Christina, Claire Julian-Reynier, Francois Eisinger, Dominique Stoppa-Lyonnet, Brigitte Bressac-de Paillerets, Hagay Sobol, and Jean-Paul Moatti. "Impact of Gene Patents on the Cost-Effective Delivery of Care: The Case of B.R.C.A.1 Genetic Testing." *International Journal of Technology Assessment in Health Care* 19, no. 2 (2003): 287-300.
- Shapiro, Carl. "Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard-Setting." In *Innovation Policy and the Economy*, edited by Adam Jaffe, Joshua Lerner and Scott Stern. Cambridge, Massachusetts: MIT Press, 2001.
- Shattuck-Eidens, Donna M., Jacques Simard, Francine Durocher, Mitsuuru Emi, and Yusuke Nakamura. "Linked Breast and Ovarian Cancer Susceptibility Gene (Method of Use)." In <http://www.uspto.gov>, edited by United States Patent and Trademarks Office. United States of America: Myriad Genetics Inc, 1998.
- Shattuck-Eidens, Donna M., Jacques Simard, Francine Durocher, Mitsuuru Emi, and Yusuke Nakamura. "Linked Breast and Ovarian Cancer Susceptibility Gene (Composition of Matter)." In <http://www.uspto.gov>, edited by United States Patent and Trademarks Office. United States of America: Myriad Genetics Inc, 1997.
- Sheehan, Kim Bartel, and Sally J. McMillan. "Response Variation in Email Surveys: An Exploration." *Journal of Advertising Research* 39, no. 4 (1999): 45-54.

- Shelling, Andrew. "Direct-to-Consumer Marketing of Genetic Testing." Paper presented at the NSU Screening Symposium 2008: Get screened and live forever? Wellington, New Zealand 2008.
- Sheremata, Lori, and E. Richard Gold. "Creating a Patent Clearinghouse in Canada: A Solution to Problems of Equity and Access." *Health Law Review* 11, no. 3 (2003): 17-21.
- Simons, Malcolm. "Genomic Mapping Method by Direct Haplotyping Using Intron Sequence Analysis Variations." 1991.
- . "Human Leukocyte Antigen (H.L.A.) Locus-Specific Primers." 1998.
- . "Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes." 1991.
- Simons, Malcolm J. "Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes." 1993.
- . "'Junk DNA' Non-Coding Patents: The Inventor's View." 2004.
- Smith Kline & French Laboratories Ltd V Attorney-General*, 4 TCLR 199 (1991).
- Spray Refrigeration Co. V. Sea Spray Fishing, Inc.*, 322 F. 2d 34 (1963).
- Sprout, Waldron & Co. V. Bauer Bros. Co.*, 26 F. Supp. 162 (1938).
- Statistics New Zealand. "Biotechnology in New Zealand 2005." 2006.
- . "Biotechnology Survey: 2007." 2008.
- Stott, Mike, and Jill Valentine. "Impact of Gene Patenting on R&D and Commerce." *Nat Biotech* 21, no. 7 (2003): 729.
- Straus, Joseph, Henrik Holzapfel, and Mattias Lindenmeir. *Genetic Inventions and Patent Law: An Empirical Survey of Selected German R&D Institutions*. Munchen: Verlag Medien Design, 2004.
- Tavtigian, Sean V., Alexander Kamb, Jacques Simard, Fergus Couch, Johanna M. Rommens, and Weber; Barbara L. "Chromosome 13-Linked Breast Cancer Susceptibility Gene." edited by United States Patent and Trademarks Office. United States of America: Myriad Genetics Inc, 1998.
- The Royal Society. "Keeping Science Open: The Effects of Intellectual Property Policy on the Conduct of Science." In *Royal Society reports: The Royal Society*, 2003.

- Thomas, Sandy M. "Reply to "Impact of Gene Patenting on R&D and Commerce"." *Nat Biotech* 21, no. 7 (2003): 731.
- Thomas, Sandy M., and N. Birtwistle. "Public-Sector Patents on Human DNA." *Nature* 388, no. 6644 (1997): 709.
- Thomas, Sandy M., A. R. W. Davies, and et al. "Ownership of the Human Genome." *Nature* 380, no. 6573 (1996): 387-88.
- Thomas, Sandy M., Michael M. Hopkins, and Max Brady. "Shares in the Human Genome - the Future of Patenting DNA." *Nat Biotech* 20, no. 12 (2002): 1185.
- Thumm, Nikolaus. "Patents for Genetic Inventions: A Tool to Promote Technological Advance or a Limitation for Upstream Inventions?" *Technovation* 25, no. 12 (2005): 1410-17.
- . *Research and Patenting in Biotechnology: A Survey in Switzerland*. Bern: Swiss Federal Institute of Intellectual Property, 2003.
- Tizard, Judith. "Cabinet Paper: An Experimental Use Exception for New Zealand's Patent Legislation." 2006.
- . "Review of the Patents Act 1953 Stage 3: Part 1." 2003.
- United Nations Educational, Scientific and Cultural Organisation. "Universal Declaration on the Human Genome and Human Rights." 1997.
- United States Patent and Trademark Office. "General Information Concerning Patents." 2005.
- . "Utility Examination Guidelines." 2001.
- United Telephone Co V Sharples*, 29 Ch D 164 (1885).
- University of Otago. "Cancer Genetics Laboratory Website." 2006.
- University of Rochester V. Gd Searle & Co, Inc, Monsanto Company, Pharmacia Corporation, and Pfizer Inc*, (2004).
- Vince, Gaia. "New Zealand's Blossoming Biotech Sector." *New Scientist*, no. 2551 (2006): 54.
- Wadman, Meredith. "Ethical Terms Set for Breast Cancer Test." *Nature* 390, no. 6658 (1997).

- Walsh, John P., Ashish Arora, and Wesley M. Cohen. "Effects of Research Tool Patents and Licensing on Biomedical Innovation." In *Patents in the Knowledge-Based Economy*, edited by Wesley M. Cohen and Stephen A. Merrill. Washington, DC: National Academies Press, 2003.
- Walsh, John P., Charlene Cho, and Wesley M. Cohen. "View from the Bench: Patents and Material Transfers." *Science* 309, no. 5743 (2005): 2002-03.
- Weissleder, Ralph, Ching-Hsuan Tung, Umar Mahmood, Lee Josephson, and Alexei Bogdanov. "Intramolecularly-Quenched near Infrared Fluorescent Probes." The General Hospital Corporation (Boston, MA), 2003.
- . "Intramolecularly-Quenched near Infrared Fluorescent Probes." The General Hospital Corporation (Boston, MA), 2000.
- Whittemore V Cutter*, 29 F. Cas. 1120 (1813).
- Williams-Jones, Bryn. "'Be Ready against Cancer, Now': Direct-to-Consumer Advertising for Genetic Testing." *New Genetics and Society* 25, no. 1 (2006): 89-107.
- Williamson, A. R. "Gene Patents: Socially Acceptable Monopolies or an Unnecessary Hindrance to Research?" *Trends in Genetics* 17, no. 11 (2001): 670-73.
- World Health Organisation Genomic Resource Centre. "Case Study: New Zealand." World Health Organisation.
- World Trade Organisation. 2000. Canada - Patent Protection of Pharmaceutical Products. In, http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds114_e.htm. (accessed 17 August 2007).

Appendix One

Gene patents

The ability to patent life forms stems from a United States Supreme Court (SC) decision in *Diamond v Chakrabarty*, in which the SC ruled that a live, human-made micro-organism was patentable subject matter under US patent law. The SC decision was made on the basis that Chakrabarty's micro-organism (a genetically engineered bacterium capable of breaking down crude oil) was "not nature's handiwork, but his own" and therefore patentable as a "manufacture" or "composition of matter".²⁶⁸ Since this case, it has been recognised that isolating and purifying a product of nature can result in a patentable invention, provided a utility for that invention can be identified.²⁶⁹ This development, along with the enactment of the Bayh-Dole Act, and the issuance of the Cohen-Boyer patent heralded the beginning of the commercial genomics revolution.²⁷⁰

Various types of gene patents have been identified, each of which has different effects and implications. The patent types discussed below are not necessarily mutually exclusive – a patent may fall into one or more categories depending on its claims. In addition, particular families of patents may cover a number of these categories to ensure that the patentee has market exclusivity in a particular area.

²⁶⁸ *Diamond, Commissioner of Patents and Trademarks V. Chakrabarty*, 447 U.S. 303 (1980).

²⁶⁹ Since 2001, the utility identified must be "specific, substantial, and credible": United States Patent and Trademark Office, "Utility Examination Guidelines."

²⁷⁰ The Cohen-Boyer patents were three patents providing methods for gene cloning. See "The Evolution of Biotechnology" in Ernst & Young, "Beyond Borders: Global Biotechnology Report 2006," in *Global Biotechnology Report (2006)*.; Sally Smith Hughes, "Making Dollars out of DNA: The First Major Patent in Biotechnology and the Commercialization of Molecular Biology, 1974-1980," *Isis* 92, no. 3 (2001).

Composition of matter or product patents

Genetic composition of matter patents are patents that include the isolated and purified gene (cDNA) and all derivative products (e.g. recombinant proteins or drugs, viral vectors and gene transfer therapies, transfected cells, cell lines and higher order animal models) in which the patented gene has been inserted or knocked out.²⁷¹ Such patents treat genes as chemical compounds, and include substances such as human growth hormone, human insulin and other proteins that can be isolated and purified from human blood and urine.²⁷² These types of patents are characterized by the OECD as 'DNA coding for industrially useful expression products', resulting in claims over a) DNA of specific function; b) recombinant vectors; c) a genetically modified organism; and d) a method for producing a polypeptide from the claimed DNA.²⁷³ A number of these types of patents were issued early in the genomics revolution. Patents of this kind are now less commonly granted in the area of genetics,²⁷⁴ though much of the ethical and legal debate centres on patents of this kind.

Process patents

A process patent claims processes or methods relating to DNA, for the purposes of analysing, cloning, modifying, sequencing, purifying or making DNA. A process patent does not, unlike some of the above examples, have the effect of monopolising a gene or gene sequence itself. However, many process patents can be valuable research tools, used in the laboratory for research or diagnostic

²⁷¹ Jon F. Merz et al., "Disease Gene Patenting Is a Bad Innovation," *Molecular Diagnosis* 2, no. 4 (1997).

²⁷² Rebecca S. Eisenberg, "Structure and Function in Gene Patenting," *Nature Genetics* 15, no. 2 (1997), Merz and Cho, "What Are Gene Patents and Why Are People Worried About Them?"

²⁷³ Oldham, "Global Status and Trends in Intellectual Property Claims: Genomics, Proteomics and Biotechnology." at 36, paraphrasing Organisation for Economic Cooperation and Development, "Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies."

²⁷⁴ Indeed, patents of this kind for genes per se would not be patentable, as they would not be novel due to the publication of the human genome. After the issuance of the USPTO's Utility Guidelines in 2001, patents of this type also became more elusive.

purposes. The earliest examples of patents of this kind are the Cohen-Boyer patents, the first of which was issued in December 1980, which describe a process for cloning and amplifying DNA.²⁷⁵ The GTG patents on methods of analysis of non-coding DNA are also an example of process patents (see 0).

Diagnostic gene patents

Diagnostic or 'disease gene' patents typically claim the characterization of an individual's genetic makeup at a particular disease-associated locus when performed for the purpose of diagnosis or prognosis. All known methods of testing used to describe the association of a genetic difference with a phenotype are covered by the patent, because the discovery that is patented is the genetic difference itself, rather than the method used to observe the difference.²⁷⁶ In a review of patents claiming gene sequences issued between 1981 and 1994, Thomas et al found diagnostics to be the fifth most prevalent type of patent in Europe and the United States, but the second most prevalent type of patent in the United States alone.²⁷⁷ In a follow-up review in 1995, diagnostics were the most prevalent type of patent in Europe and the United States.²⁷⁸ The identification of genes involved in a disease results in claims over: a) the DNA sequence of a wild-type gene (allele); b) mutated forms of the allele; c) DNA primers for amplification of the sequence; d) testing methods for mutations; e) reagent kits; and e) screening methodology using the gene/polypeptide as a target for identifying potential therapeutic products.²⁷⁹

²⁷⁵ Hughes, "Making Dollars out of DNA: The First Major Patent in Biotechnology and the Commercialization of Molecular Biology, 1974-1980."

²⁷⁶ Merz and Cho, "What Are Gene Patents and Why Are People Worried About Them?"

²⁷⁷ Sandy M. Thomas, A. R. W. Davies, and et al, "Ownership of the Human Genome," *Nature* 380, no. 6573 (1996).

²⁷⁸ Sandy M. Thomas and N. Birtwistle, "Public-Sector Patents on Human DNA," *Nature* 388, no. 6644 (1997).

²⁷⁹ Oldham, "Global Status and Trends in Intellectual Property Claims: Genomics, Proteomics and Biotechnology." at 36, paraphrasing Organisation for Economic Cooperation and Development, "Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies."

The BRCA1 and BRCA 2 diagnostic patents, covering the genes associated with hereditary breast and ovarian cancer, are probably the most well-known disease-gene patents.²⁸⁰ Other well-known disease gene patents include those which cover colon cancers (HNPCC, FAP), cystic fibrosis (CFTR), haemochromatosis (HFE), late-onset Alzheimer's disease (Apo-E), Canavan disease, Charcot-Marie-Tooth Disease, and others. As discussed below, these types of patents have been used to control, through exclusive or restrictive licensing, the provision of diagnostic genetic testing services (at least in the United States).

A number of problems with disease-gene patents have been identified. First, any one gene may have multiple patents which each claim the diagnosis of different polymorphisms (i.e. different disease-causing mutations). In the United States for example, several patents have been issued which cover different mutations in the cystic fibrosis gene.²⁸¹ In addition, some diseases are caused by multiple genes, which can cause difficulties for ownership and access when there are many known mutations in multiple causative genes. Patents can also be issued for the exact same test when it is performed for different diagnostic or prognostic purposes.²⁸² In these situations (in the United States at least), a patent "thicket" is created, causing difficulties for laboratories and researchers in negotiating and securing multiple licenses and paying royalties to multiple patent owners.²⁸³ In addition, since a disease-gene patent covers all methods of testing for a particular mutation, there is no way of "inventing around" it, and the patent(s) may be used to monopolise a particular test.²⁸⁴

²⁸⁰ However in some countries, Myriad also holds composition of matter patents over the BRCA1 genes: M Rimmer, "Myriad Genetics: Patent Law and Genetic Testing," *European Intellectual Property Review* 25, no. 1 (2003).

²⁸¹ The CFTR genes have not been patented in New Zealand.

²⁸² For example, in the United States, the Apo-E test has been patented for a number of different uses, including determining whether a patient is at risk of early-onset Alzheimer's, assessing an Alzheimer's disease patient's prognosis, determining a course of therapy based on pharmacogenetic receptivity, and assessing a patient's prostate cancer risk. Only two of these uses have been patented in New Zealand.

²⁸³ Heller and Eisenberg, "Can Patents Deter Innovation? The Anticommons in Biomedical Research."

²⁸⁴ Merz et al., "Disease Gene Patenting Is a Bad Innovation."

Disease gene patents are also often issued well after first publication of their discovery has been made. This can create a disincentive for laboratories to develop their own tests, because once they have done so, they may face a request for royalties or licensing fees, or even a prohibition against performing the test.²⁸⁵

Functional use patents

Functional use patents are based on the discovery of the role particular genes play in disease or other bodily and cellular functions or pathways. These patents claim both methods and compositions of matter (usually drugs) that can be used to regulate the gene or effect its functioning. Functional use patents are characterized by the OECD as 'genes controlling biological pathways (i.e. for preventing the entry of pathogens such as viruses into a cell)'. These patents result in claims over: a) receptor peptide/polypeptide for a defined DNA sequence; b) DNA coding for the receptor; c) a transformed cell expressing the receptor; d) an assay system comprising the transformed cell; e) a method for identifying an agonist(s)/antagonist(s) of the claimed receptors(s); and f) agonist(s)/antagonist(s) of the claimed receptor(s) identified by the claimed method.²⁸⁶

Examples of functional use patents include:

- A patent owned by the University of Rochester that claimed methods and compositions of matter for the selective inhibition of the Cox-2 gene, which prevents inflammation and pain. The patent attempted to claim all drugs that worked through targeting the Cox-2 gene, including the operation of three drugs that came to market subsequent to the patent issuing

²⁸⁵ Bunk, "Researchers Feel Threatened by Disease Gene Patents."

²⁸⁶ Oldham, "Global Status and Trends in Intellectual Property Claims: Genomics, Proteomics and Biotechnology." at 36, paraphrasing Organisation for Economic Cooperation and Development, "Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies."

- (Celebrex, Bextra and Vioxx).²⁸⁷ This patent was invalidated in 2004 for failing to provide adequate written description of the claimed invention.²⁸⁸
- A patent licensed to Ariad Pharmaceuticals that claims “the basic regulation of any genes by reducing intracellular activity of the transcription factor NF-κB”.²⁸⁹ On the day of the patent issuing, Ariad sued Eli Lilly Inc for infringement for its drugs Evista and Xigris, which operate through the same pathways. Commentators initially felt that Ariad had a slim chance of success in enforcing such a broad patent.²⁹⁰ However, on 4 May 2006, a federal jury ruled that Eli Lilly had infringed the patent and ordered the company to pay \$65 million in back royalties to Ariad, and a 2.3 percent royalty on its future sales of Evista and Xigris.²⁹¹
 - A patent issued to Pfizer in late 2002 claiming any selective PDE5 inhibitor used to treat impotence.²⁹² Prior to the patent even issuing in the United States, it had been invalidated in the United Kingdom for obviousness.²⁹³ Subsequent to the patent issuing in the United States, Pfizer issued infringement proceedings against Bayer and GlaxoSmithKline for their drug Levitra, and Eli Lilly for Cialis.²⁹⁴

²⁸⁷ Merz and Cho, "What Are Gene Patents and Why Are People Worried About Them?"

²⁸⁸ *University of Rochester V. Gd Searle & Co, Inc, Monsanto Company, Pharmacia Corporation, and Pfizer Inc*, (2004).

²⁸⁹ Merz and Cho, "What Are Gene Patents and Why Are People Worried About Them?"; US patent number 6,410,516.

²⁹⁰ *Ibid.*; Derek Lowe, "In the Pipeline: Ariad's Day in Court," *Corante Blog* (2006)..

²⁹¹ Andrew Pollack, "Lilly Loses Patent Lawsuit to Ariad, M.I.T., Harvard Drug Company to Pay \$65m for Infringing Patent Covering Protein Discovered in Part by M.I.T. Researchers," *The Tech Online* 126, no. 24 (2006).

²⁹² Merz and Cho, "What Are Gene Patents and Why Are People Worried About Them?"; US patent number 6,469,012.

²⁹³ *Lilly Icos Llc V. Pfizer Limited*, BAILII (2000).. Pfizer's appeal was dismissed by the Court of Appeal (*Lilly Icos Llc v Pfizer Ltd* (1) [2002] EWCA Civ 1 (23rd January, 2002)).

²⁹⁴ Pharmafocus, "Pfizer Sues Struggling G.S.K. Over Viagra Patent," (1 November 2002).

Improvement patents

An improvement patent “is a patent on an improved DNA sequence, such as a modified sequence, or an improved DNA process”.²⁹⁵ Where the original sequence or process is patented, it is likely that the secondary patent holder would need a license from the original patentee to commercialise the improvement.

Legal and ethical objections to gene patents

In the early years of the genomics revolution (1990-1997²⁹⁶), companies were applying for (and being granted) patents over human genetic material once it had been isolated and purified and some limited function for it had been identified. Problems with these early patents arguably apply to patents in many new industries, and include problems with utility (i.e. where an invention’s utility is not defined with sufficient specificity), breadth (i.e. where a patent’s claims can arguably be constructed to cover a broader field of use than originally intended), and one-use/all-use claims (i.e. where a patent’s claims can be interpreted to include uses that were not considered or intended²⁹⁷). Greater awareness of these issues by patent examiners and the introduction of the Utility Examination Guidelines in the United States have reduced the numbers of patents with these types of problems being granted.²⁹⁸ However, patents for genetic inventions

²⁹⁵ David B. Resnik, *Owning the Genome: A Moral Analysis of DNA Patenting* (New York: State University of New York Press, 2004), p. 54.

²⁹⁶ Ernst & Young, "Beyond Borders: Global Biotechnology Report 2006."

²⁹⁷ Human Genome Sciences’ patent on the gene for the CCR5 receptor is a good example. See note 101 above. See also Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation.", p. 296-297.

²⁹⁸ United States Patent and Trademark Office, "Utility Examination Guidelines." Nicol and Nielsen (2003) and Walsh et al (2003) found that many early broad patents were not being enforced, likely because they may not have withstood legal challenge.

continue to be granted in most countries, including New Zealand, where the requirements for patentability have been met.²⁹⁹

Fundamental objections to patents on genetic material generally fall into three categories: legal, ethical, and social. Those who object to gene patents on a legal basis argue that genes and gene sequences do not meet the criteria for patentability (i.e. they are not novel, do not have adequately described utility, or are not an invention). One of the more common arguments is that genes and gene sequences are, in effect, naturally occurring information that is 'discovered' rather than invented, and which therefore cannot be patentable.³⁰⁰ There are subtleties within this broad argument. For example, Duffield argues that the assumption "that genes operate independently and perform single functions is demonstrably false", and therefore awarding patent rights on the basis of a single disclosed function is therefore a generous interpretation of the inventor's work.³⁰¹ On the other hand, McGee argues that "while disease genes are in one sense discoverable by conventional means, their utility and indeed their meaning as a commercial object is not discovered but rather invented". He argues that treating genes as a code to be stumbled upon does not take account of "the immensely difficult epidemiological task of clarifying otherwise diffuse relationships between particular environments and genes, and between particular groups and genes". This task includes identifying particular groups of people affected by mutations, utilising methods for associating mutations with a phenotype, and the methods for using such epidemiological evidence to make a diagnosis. McGee argues that these inputs are not natural phenomena nor easily stumbled upon.³⁰²

²⁹⁹ As noted in section 2.3, the requirements for patentability in New Zealand are currently less stringent than in the United States, United Kingdom and Europe, with no statutory requirement that the invention be novel and useful.

³⁰⁰ Merz et al., "Disease Gene Patenting Is a Bad Innovation."; Nuffield Council on Bioethics, "The Ethics of Patenting DNA: A Discussion Paper." There is also an ethical basis for this argument.

³⁰¹ Duffield, G. (2006), *DNA Patenting: implications for public health research*, Bulletin of the World Health Organisation, 84(5): 388-389.

³⁰² G McGee, "Gene Patents Can Be Ethical," *Cambridge Quarterly of Healthcare Ethics* 7 (1998).

Paradise et al carried out an analysis of whether the claims contained within patents covering genetic material met the United States statutory requirements for patentability, i.e. utility, novelty, non-obviousness and the disclosure requirements of written description, enablement, best mode, and definiteness. Paradise et al identified 74 patents on genetic material, covering genes which play a role in nine genetic diseases. Each claim in each patent was examined by the project personnel against the criteria for patentability. Where a claim did not meet one or more of the requirements for patentability, it was deemed to be problematic. Paradise et al found that 38% of claims were problematic, and that some claims had multiple problems. In addition, many patents claimed more than what was actually discovered by, for example, “claiming the sequence of a protein within a patent and then also asserting rights over all of the DNA sequences that encode for that protein without describing those DNA sequences”. Paradise et al also found that some patents exhibited problems with written description by claiming discoveries the patent holder did not specifically describe. Other patents were found to have problems in relation to utility, by, for example, showing how a polymorphism could be used to predict asthma, but then also claiming other uses of the polymorphism to predict other conditions, even though the inventor did not explicitly show that the patent was linked to those conditions.³⁰³

Ethical objections to patents on human genes generally rest upon the premise that patents that assert rights over human DNA sequences are unacceptable because of the special status of human DNA.³⁰⁴ The argument that DNA has a special status springs from the proposition that genes are the “common heritage of humanity”³⁰⁵, and are therefore inalienable, or public property, or merely discoveries (rather than inventions). Indigenous cultures, including Māori, also

³⁰³ Jordan Paradise, Lori Andrews, and Timothy Holbrook, "Patents on Human Genes: An Analysis of Scope and Claims," *Science* 307, no. 5715 (2005).

³⁰⁴ For further information see Nuffield Council on Bioethics, "The Ethics of Patenting DNA: A Discussion Paper."

³⁰⁵ Scientific and Cultural Organisation United Nations Educational, "Universal Declaration on the Human Genome and Human Rights," (1997).

have objections to patents on genes and other life-forms, usually based on their world-view and the place of living creatures within that world view.

Social and other objections to patents on genetic material are many and varied. Some argue that the process for the discovery of genes and their functions (particularly since the mapping of the genome) is now routine³⁰⁶, and awarding patent rights is incommensurate with the level of effort and skill involved in making such discoveries.³⁰⁷ Others have argued that particular types of patents and licensing practices will have negative effects on research and the provision of genetic testing services. These arguments, and related evidence, are covered in more detail in section 2.5 above.

Analysis of gene patents and research tool patents granted in New Zealand as compared with overseas jurisdictions

Following is a table outlining the genetic tests available in New Zealand,³⁰⁸ the relevant New Zealand patent number, and the relevant United States patent number(s). Tests marked with a * have been identified in a previous study by Cho et al as being genetic tests that some laboratories stopped performing because of patents.³⁰⁹ It should be noted that this is a rather crude method of identifying the relevant gene patents in New Zealand. Not all patents that are identified will definitely pertain to the test, and there will be patents that have not been identified as relevant. In addition, there will be laboratory processes and materials that may be patented but which are not identified in this table. Notwithstanding, the table serves as a rudimentary comparison of the difference

³⁰⁶ Williamson, "Gene Patents: Socially Acceptable Monopolies or an Unnecessary Hindrance to Research?"

³⁰⁷ Cho et al., "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services.", Nuffield Council on Bioethics, "The Ethics of Patenting DNA: A Discussion Paper." This argument is obviously a variation on the arguments that gene patents don't meet patentability requirements.

³⁰⁸ As indicated in Human Genetics Society of Australasia, "DNA Diagnosis of Genetic Disorders in Australasia."

³⁰⁹ Cho et al., "Effects of Patents and Licenses on the Provision of Clinical Genetic Testing Services."

in the number of gene patents in the United States as compared with New Zealand. From the comparison below, I conclude that genes and genetic tests have not been patented to the same extent in New Zealand. Only a few of those patents identified as 'problematic' by Cho et al have been patented in New Zealand. Where available, the price charged for the test by LabPlus (Auckland) has been included for interest.

Table 3: Patents relating to genetic tests in New Zealand and the United States

Test	NZ Patent Number	US Patent Number(s)	Price (Labplus)
Achondroplasia			
Adrenoleukodystrophy Adrenomyeloneuropathy		5644045	Charge 1 and 2: \$663.30; specific mutation: \$504.70
Angelman syndrome	527126 (exam)	7175988	\$487.32
Ankylosing spondylitis (HLA B27 typing)			\$119.66
Apert syndrome			
Apolipoprotein*	257215	5508167, 6027896, 5716828	
Beta-2-adrenoreceptor (ADRB2)			
Butyrylcholinesterase genotyping		6271175 (pharmacogenetic patent)	
BRCA1 &2	291624	5753441	Sequencing charges 1,2,3: \$983.77; specific mutation: \$195.92-\$215.97
CADASIL (Notch 3 gene)		7138234	
Carnitine palmitoyl transferase deficiency type II		7160694?	
Charcot-Marie Tooth neuropathy type 1A*		5780223, 5691144	
Cowden syndrome			
Cystic Fibrosis		6984487	
Cytochrome P450 genes – CYP2D6, CYP2C9, CYP3A4	294019	6984489?, 5976850	
Deafness – Connexin- 26			
Drash and WAGR syndromes			

Test	NZ Patent Number	US Patent Number(s)	Price (Labplus)
Duchenne/Becker muscular dystrophy*		5541074	\$515
Factor V Leiden*		5874256	\$103
Familial Adenomatous Polyposis*		5352775	\$474.86
Familial Amyloidotic Polyneuropathy			
Familial defective apoB-100			
Familial Renal Amyloidosis			
Fibroblast Growth Factor Receptor Disorders (FGFR1, FGFR2, FGFR3)			
Fragile X syndrome*		6107025	\$360.50
Haemochromatosis*	522521	5705343	\$82.40-\$159.65
Hematological Malignancies – APLM, BCR-ABL, PML RARa rearrangements, t(8:21)&inv16			
Haemophilia A & B			\$164.80-\$1,751
Hereditary dysfibrinogenaemias			
Hereditary nonpolyposis colon cancer			
Hereditary pancreatitis (cationic trypsinogen mutations)			
Hereditary neuropathy with liability to pressure palsies			
Huntington's disease*		4666828	\$360.50
Hypochondroplasia			
IGF2 overgrowth disorder			
Infertility			
LDL receptor (hypercholesterolaemia)			
Lipoprotein lipase			
LQT syndrome specific mutation	330743	6972176 6582913 6787309	\$318.58
MEN2A and MEN2B			
Mitochondrial mutations			
Motor Neuron Disease (familial)			
Myotonic dystrophy			\$566.50
Nephrogenic Neurhypophyseal Diabetes Incipidus			
Pfeiffer syndrome			

Test	NZ Patent Number	US Patent Number(s)	Price (Labplus)
Prader-Willi syndrome			\$524.41
Prothrombin (variant 20210 G->A)			\$77.25-\$133.90
PTEN			
Retinoblastoma			
Spinocerebellar ataxia types 1 and 3		5834183, 5840491	\$669.50
Thalassaemias (& other haemoglobinopathies)			\$412; prenatal test: \$463.50
X-linked hypogammaglobulinaemia			
X-linked lymphoproliferative disease			

Table 2 below is an augmented version of the table found in Nicol and Nielsen’s research compiling patents on research tools in Australia. An additional column has been added to this table with the relevant patent information for New Zealand.

Table 4: Patents on research tools in Australia and New Zealand

Patent name	Patent holder	Description	Australian patent number	New Zealand patent number
Biologically functional molecular chimeras (USPTO numbers 4,237,224 & 4,740,470 the “Cohen-Boyer patents” – now expired)	Board of Trustees Stanford University	These patents cover a process for making molecular chimeras and proteins produced using recombinant DNA.	Not patented in Australia	Not patented in New Zealand
Human G-protein chemokine receptor HDGNR10 (USPTO number	Human Genome Sciences Inc	The CCR5 receptor is a chemokine receptor, and was patented by HGS as having a number of general utilities. Scientists later discovered that CCR5 is the receptor for the HIV virus. HGS is licensing others for this use of the patented CCR5 receptor.	Application number 199526632, possibly lapsed.	527126: Granted

6,025,154)				
Primate embryonic stem cells (USPTO 6,200,806); Hematopoietic differentiation of pluripotent embryonic stem cells (USPTO 6,280,718)	Wisconsin Alumni Research Foundation	These patents cover the isolation and differentiation of human embryonic stem cells.	No Australian record in respect of these particular patents, but other related ones have been granted.	No New Zealand records in respect of these particular patents. Related patents are currently being examined and have recently been the subject of an Opposition Hearing (2007/22) relating to the “contrary to morality” clause (section 17). ³¹⁰ Other patents granted include “Method of making embryoid bodies from primate embryonic stem cells” (520700), also from WARF.
Human stem cells (USPTO	Johns Hopkins University	“CD34 is an antigen found on stem cells, which are undifferentiated blood cells found in bone marrow. The	No records found.	No records found.

³¹⁰ However, the hearing decision on this is not publicly available, and the patent itself is still “under examination” on the IPONZ database.

4,714,680); Human stem cells and monoclonal antibodies (USPTO 4,965,204; 5,035,994; 5,130,144);		United States patent was filed following the discovery of a particular antibody (My-10) that selectively binds to (and detects) CD34. All antibodies that bind to CD34 were claimed. The technology employing the binding of antibodies to CD34 was useful in the development of cancer therapies, specifically as an alternative to bone-marrow transplants." ³¹¹		
Method of inhibiting prostaglandin in a human host (USPTO 6,048,850)	University of Rochester	"This patent claims broad rights over the Cox-2 enzyme, and any compounds developed to inhibit the enzyme. It now appears that compounds developed to inhibit the enzyme may have broad applicability – in addition to one of these compounds being useful as a pain medicine, it may also have some anti-cancer properties." ³¹²	No records found but other patents relating to Cox-2 do exist.	No records found but other patents relating to Cox-2 do exist, as do a number of other patents owned by the University of Rochester.
Nuclear factors associated with transcriptional regulation (USPTO 6,410,516)	Harvard College, MIT, Whitehead Institute	NF-kB is a protein "that acts as a sort of master biological switch that turns dozens of genes on or off". ³¹³ The patent contains 203 separate claims covering methods of treating disease by regulating the NF-kB family of molecules.	No record found.	No record of this patent found, although a patent held by Millenium Pharmaceuticals on the use of the NF-kB

³¹¹ Described by Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry."

³¹² Described by Ibid.

³¹³ Pollack, "Lilly Loses Patent Lawsuit to Ariad, M.I.T., Harvard Drug Company to Pay \$65m for Infringing Patent Covering Protein Discovered in Part by M.I.T. Researchers."

				activation inhibitor is on the IPONZ database (337364).
Methods of screening for protein inhibitors and activators (USPTO 4,980,281; 5,266,464; 5,877,007)	ICT Pharmaceuticals Inc, now known as Housey Pharmaceuticals Inc	These patents cover methods of screening for pharmaceutical compounds.	Application number 199064271, possibly lapsed.	No records found.
Site specific recombination of DNA in eukaryotic cells (USPTO 4,959,317)	E.I. Dupont de Nemours and Co	This patent describes a method of using site specific recombination of DNA as a genetic engineering tool, particularly by inactivating known genes. After a number of years in which access to Cre-lox was restricted by DuPont, an agreement was signed between DuPont and the NIH in 1998 allowing noncommercial research use without a licence. However, transfer of Cre-lox mice requires entry into a Material Transfer Agreement on terms that restrict use.	A related patent has been granted to DuPont: Site specific recombination of DNA in plant cells, AU639059.	No records of US or related Australian patents found.
Purified thermostable enzyme (USPTO 5,079,352)	Cetus Corp, assigned to F. Hoffmann La Roche	This patent describes a method for amplifying DNA sequences and detecting them if present using a probe. This technology is widely used in genetic analysis.	Patent accepted in Australia AU632857 in 1996.	Patent accepted in New Zealand 221517 in 1991.

Transgenic non-human animals (USPTO 4,736,866)	President and Fellows of Harvard College	This patent was one of the first, and most controversial, biotechnology patents. It describes a method for producing a non-human mammal with a predisposition for developing cancer, which is useful in cancer research. Equivalent patents have been the subject of litigation in Europe ³¹⁴ and Canada. ³¹⁵	No records found, although an application by Harvard College exists for B-cell deficient transgenic non-human animals. Other Australian patents have been granted in respect of other transgenic non-human animals.	No records found, and there is no record of the application by Harvard College for the B-cell deficient transgenic non-human animals. Other New Zealand patents have been granted in respect of other transgenic non-human animals.
Hepatitis C virus (HCV) (suite of patents)	Chiron Corporation Inc	“Chiron Corp has a suite of patents relating to HCV in a number of jurisdictions, including claims to the components of the virus itself and its use in diagnostic tests, vaccines and drug development. Chiron is widely known for aggressively enforcing its patents. Murex Ltd sought to have a Chiron patent revoked in Australia in the early 1990s. ¹¹⁵ Although there were a number of interlocutory decisions in this matter ¹¹⁶ and case went	Australian status not noted.	Five relevant patents found: 319786, 333431, 316186, 337056, 551319.

³¹⁴ <http://www.nature.com/news/2004/040830/full/nrd1509.html>; <http://www.epo.org/about-us/press/releases/archive/2001/07112001.html>

³¹⁵ The Supreme Court of Canada held that a higher life form is not patentable because it is not a “manufacture” or “composition of matter” within the meaning of “invention” within section 2 of the Canadian Patent Act 1985: *Harvard College v. Canada (Commissioner of Patents)*, [2002] 4 S.C.R. 45, 2002 SCC 76.

		to hearing before Burchett J, it ultimately settled, with Chiron granting a licence to Murex.” ³¹⁶		
--	--	---	--	--

³¹⁶ Described by Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry."

Appendix Two

Full text of online survey



Patents and the healthcare and research sectors in New Zealand

Thank you for your interest in taking part in this survey.

The aim of this research is to investigate:

- the effects of patents, and particularly human gene patents, on the activities of health and research organisations in New Zealand; and
- the involvement of New Zealand health and research organisations in genetic-based research, and the resulting patenting and licensing activity.

This research is carried out by the Human Genome Research Project, a three year project funded by the Law Foundation of New Zealand. For more information on the Human Genome Research Project, go to www.otago.ac.nz/law/genome.

The information collected in this survey will be kept secure through the use of tamper-proof URLs and password-only access by the investigators to the survey reports. Identifying details of survey respondents will be kept confidential. In any reports or publications concerning this research, any answers given by respondents will be reported in a generalised fashion (e.g. “a person involved in research in a Biotechnology Company commented that...”).

The final survey question allows you to provide your email address if you wish to receive a copy of the results.

At the end of the project any personal information will be destroyed immediately except that, as required by the University's research policy, any raw data on which the results of the project depend will be retained in secure electronic password-access-only storage for five years, after which it will be destroyed.

If you have any questions about our project, either now or in the future, please feel free to contact either:-

Aphra Green
Human Genome Research Project
Phone: 04 977 9943

Richman Wee
Human Genome Research Project
Phone: 03 479 5324

Survey questions

Introductory questions

Position:

Organisation:

Is your organisation primarily:

- carrying out research (go to page 3)
- providing clinical genetic testing services (go to page 9)
- other (please specify): (e.g. providing legal advice, consulting etc)
(go to page 14)

Questions for research organisations

How would you classify the nature of research conducted by your group?

- Gene identification
- Cancer research
- Virus research
- Protein-based research
- Plant/animal research
- Bioinformatics
- Other enabling technology
- Other health research
- Other (please specify)

What proportion of your research is publicly funded?

- No public funding
- 1-25%
- 26-50%
- 51-75%
- 76-100%

Licences held

Do you pay licence fees or make royalty payments to any patent holder in respect of any of the activities carried out by your organisation (i.e. licensing-in)?

- Yes
- No

How many licensing-in agreements do you have?

For each licensing-in agreement, please specify the technology that is licensed in, where the patentee is based, and whether the licence is exclusive or non-exclusive.

(For example: “PCR/taq, Roche Diagnostics Ltd, based in United States, non-exclusive licence”)

Has your group experienced any difficulty in gaining a license to use patented tools or materials ('licensing in')?

- Yes
- No
- Have never attempted to licence in

If yes, did such difficulties relate primarily to the cost of entering into licensing-in arrangements or to some other aspect (e.g.. reach-through rights)?

Have you ever decided not to commence a research programme because of a patent (or patents)?

- Yes
- No

If yes, please specify which patents affected your decision:

Are you aware of whether or not any other researchers or industry participants own patents relating to the research you are conducting?

- Yes
- No
- Don't know

Do you or does any other person in your organisation conduct patent searches to ensure that the research conducted by your group is not infringing patents held by others?

- Yes
- No

If yes, approximately what is the value of the resource expended by your organisation in conducting these searches? (for example: 1 person, 3 hours a week; engage patent attorney to conduct searches at approximate cost of \$xx per annum etc)

Has your organisation ever been contacted by a patent or licence-holder regarding the organisation's potential infringement of a patent?

- Yes
- No

If yes, for which patent(s) were you contacted, and what was your response to the contact?

Has notification from a patent holder or licensee ever prevented you from continuing to perform any research?

- Yes

No

If yes, did the patentee threaten litigation if your group continued research?

Which particular research or patent was involved?

Has your organisation ever had to change its research programme (once research had already commenced) because a patent blocked access to key research tools or materials?

Yes

No

If yes, please provide detail:

To what extent do existing patents influence your organisation's choice of research programme?

Heavily

Somewhat

No influence

Has your organisation ever been refused a patent licence?

Yes

No

If yes, what patent(s) were you refused a licence for?

What reason was given for the refusal to licence?

Did the refusal cause your group to abandon that line of research?

- Yes
- No

Has your organisation ever abandoned licensing negotiations?

- Yes
- No
- Have never entered patent licensing negotiations

If yes, what was your organisation's reason(s) for abandoning the negotiations?

Has your organisation ever been involved in patent infringement litigation as a result of the research it has undertaken?

- Yes
- No

If yes, what was the outcome of that litigation?

Patenting practices

Is patenting part of your organisation's commercial strategy?

- Yes
- No

Please provide detail if your organisation uses another method of protecting its intellectual property:

Are you aware of the requirements for patenting?

- Yes
- No
- Vaguely

Does your organisation own any patents?

- Yes
- No

How many patents are owned by your organisation?

Please classify the nature of those patents: (select one or more of the following)

- Gene sequence
- Research tool
- Gene product
- Drug
- Diagnostic
- Other (please specify): _____

Are any of your organisation's patents registered overseas?

- Yes
- No

If yes, which countries are your patents registered in?

Has your organisation ever applied for a patent for strategic reasons (e.g. applied for a patent to enable freedom to operate)?

- Yes
- No

If yes, what were your reason(s) for doing so?

In what scientific area(s) was the patent(s) that you applied for?

- Gene sequence
- Research tool
- Gene product
- Drug
- Diagnostic
- Other (please specify) _____

Licensing out

Does your organisation licence out its patented tools or products to others?

- Yes
- No

If yes, how many licensing out agreements does your group have?

Where are the licensees based?

What types of licences do you most commonly grant?

- Exclusive commercial
- Non-exclusive commercial
- Exclusive research use
- Non-exclusive research use
- Other (please specify):

Have you ever refused to grant a licence to a patented tool or product owned by your organisation?

- Yes

No

If yes, what was the reason(s) for the refusal?

Attitudes

Please provide your response to the following statements.

Patents have, in your opinion:

Resulted in more or less sharing of information among researchers, or had no effect?

- More sharing
- Less sharing
- No effect

Resulted in an increased or decreased ability to do research, or had no effect?

- Increased
- Decreased
- No effect

Decreased or increased the costs of research, or had no effect?

- Decreased
- Increased
- No effect

Decreased or increased researchers' ability to publish research results, or had no effect?

- Decreased
- Increased
- No effect

What do you consider to be the impact of allowing the patenting of biotechnology inventions on research in this industry?

- Positive
- Negative
- Varies
- No effect

More specifically, what do you consider to be the effect of human gene patents on research?

Any additional comments on the effects of patents, or gene patents in particular, on biotechnology research in New Zealand?

Does your organisation provide any clinical genetic testing services?

- Yes (if yes, continue to page 9)
- No (if no, survey ends)

This is the end of survey for organisations not providing clinical genetic testing services.

If you would like to receive a copy of the results of this research, please provide your email address:

Questions for clinical genetic testing services

Which genetic tests are provided by your organisation?

What other genetic analysis is provided by your organisation?

What proportion of the genetic tests carried out by your organisation is paid for through public funding?

- None
- 1-25%
- 26-50%
- 51-75%
- 76-100%
- All

What proportion of genetic tests do you currently send overseas for analysis?

What is the approximate cost ascribed to each of the publicly-funded tests offered by your facility?

For privately provided tests, please specify the price your organisation charges for each test:

Of the tests you send overseas, are you aware of whether any licence fees are built into the price that you are charged for each test?

- Yes
- No

If yes, please specify which tests and the approximate licence fees (if known)?

Will your organisation be introducing any new clinical genetic tests within the next year?

- Yes
- No

If yes, which test(s) do you intend to introduce?

Do you pay licence fees or make royalty payments to any patent holder in respect of any of the genetic testing activities carried out by your facility?

- Yes
- No

If yes, what licences in particular do you hold?

Have you ever coordinated or worked with another organisation in New Zealand to negotiate a joint licence for a patent pertaining to the genetic testing services you provide?

- Yes
- No

If yes, what patents were involved?

If yes, what were your reasons for coordinating or working with another organisation?

Have you ever decided not to develop or perform a test or provide a service because of an existing patent?

- Yes
- No

If yes, which patent(s) affected your decision?

Have you ever received notification from a patent holder that the testing that you were performing was the subject of a patent?

- Yes
- No

If yes, which patent(s) or genetic test(s) did the notification concern?

What was your organisation's response to this contact?

Has your organisation ever discontinued a genetic testing procedure that it previously conducted on a regular basis?

- Yes
- No

If yes, which test(s) did you discontinue?

Was the testing discontinued because of a patent held by another organisation?

- Yes
- No

If yes, did you request a licence from that other organisation either prior to or after discontinuing the service, and if so, what was the outcome of that request?

Has your organisation ever been refused a patent licence for any patents relating to the provision of genetic testing services?

- Yes
- No
- Have never sought or requested a licence

If yes, what patent(s) were you refused a licence for?

What was the reason(s) for the refusal?

Does your organisation develop its own genetic tests or test kits?

- Yes
- No

If yes, which genetic tests or test kits have you developed?

When deciding to develop a new test or test kit, do you check whether there are any patents surrounding the gene or particular test methods?

- Yes
- No

Does your organisation spend any money or utilise any resources in searching for or assessing existing patents that may affect your organisation's work?

- Yes
- No

If yes, what is the approximate annual value of the resources and money expended by your facility in searching for or assessing such patents?

Has your facility ever been offered a licence that would have enabled you to continue a genetic testing procedure but on terms that your facility considered restrictive?

- Yes
- No

If yes, please provide details as to the restrictive nature of those terms (e.g.. price, quantity etc):

If yes, did you accept or refuse the licence, and if you refused it, did this cause you to abandon the testing procedure?

Attitudes

Please provide your response to the following statements.

Patents have, in your opinion:

Made genetic testing more or less accessible to patients, or had no effect:

- More accessible
- Less accessible
- No effect

Decreased or increased the costs of genetic testing to labs, or had no effect:

- Decreased costs
- Increase costs
- No effect

Decreased or increased the costs of genetic testing to the patient, or had no effect:

- Decreased costs
- Increased costs
- No effect

Decreased or increased the costs of genetic testing to the health sector, or had no effect:

- Decreased costs
- Increased costs

- No effect

Decreased or increased the ability to develop a test, or had no effect:

- Decreased ability
- Increased ability
- No effect

Decreased or increased the quality of testing services in labs, or had no effect:

- Decreased quality
- Increased quality
- No effect

Final comments:

Does your laboratory carry out any research?

- Yes
- No

If yes, please go back and complete survey questions on pages 3-8.

Otherwise, thank you for completing this survey. If you would be willing to participate in a follow-up interview, please provide your email address:

If you would like to receive a copy of the results of this research, please provide your email address:

Questions for people who reply “Other”

Please describe the nature of your industry:

What is your interest in patenting and/or patents on human genetic material?

Attitudes

Please provide your response to the following statements.

Patents have, in your opinion:

Resulted in more or less sharing of information among researchers, or had no effect?

- More sharing
- Less sharing
- No effect

Comments:

Resulted in an increased or decreased ability to do research, or had no effect?

- Increased
- Decreased
- No effect

Comments:

Decreased or increased the costs of research, or had no effect?

- Decreased
- Increased
- No effect

Comments:

What do you consider to be the impact of allowing the patenting of biotechnology inventions on research in this industry?

- Positive
- Negative
- Varies
- No effect

Comments:

What do you consider to be the effect of broad patents on research?

Please provide your response to the following statements.

Patents have, in your opinion:

Made genetic testing more or less accessible to patients, or had no effect:

- More accessible
- Less accessible
- No effect

Comments:

Decreased or increased the costs of genetic testing to labs, or had no effect:

- Decreased costs
- Increase costs
- No effect

Comments:

Decreased or increased the costs of genetic testing to the patient, or had no effect:

- Decreased costs
- Increased costs
- No effect

Comments:

Decreased or increased the costs of genetic testing to the health sector, or had no effect:

- Decreased costs
- Increased costs
- No effect

Comments:

Decreased or increased the ability to develop a test, or had no effect:

- Decreased ability
- Increased ability
- No effect

Comments:

Decreased or increased the quality of testing services in labs, or had no effect:

- Decreased quality
- Increased quality
- No effect

Comments:

If you would be willing to participate in a follow-up interview, please provide your email address:

If you would like to receive a copy of the results of this research, please provide your email address:

Thank you for completing this survey.

Your participation is much appreciated.

Appendix Three

Interview topics – genetics services

- Any comments on results?
- Impact of GTG on clinical practice
 - Short term impacts? Long term impacts?
 - Patent searching practices?
- Confirm that no license fees/royalties paid for patented technologies
 - What about lab equipment and test kits?
 - Anticipate any in future?
- What provision (if any) is made for legal/licensing risks arising out of use of patented technologies?
 - Particularly gene patents – or has this issue largely passed?
- Any thoughts on positive impacts of patents in this area?
 - Increased availability of different tests
 - Increased quality of tests
- Evidence from survey on concern that patents had increased costs of testing for patients and labs:
 - In what way?
 - Does this indicate a future concern?
 - Result of increased media/other coverage of impacts of patents?
- Any other patents/patent types of concern in field of genetics?
- Extent of research carried out in lab?
- Reliance on common law research use exemption or public use exemption?
- Any thoughts on why patent holders do not appear to be enforcing patents here?
 - What does this mean over long term for genetic services in New Zealand?
- Any other comments?

Interview topics – biotechnology research participants

- General comments on results?

Patenting practices

- Importance of patenting to business strategy
- Is patenting most important method of protecting IP?
- Defensive patenting? Reasons for? Effect on research?

Dealings with own patents

- Licensing-out – who to? Types of licences generally granted?
- Pursuing infringers?

Positive impacts of patents

- Role of patents in encouraging research?
- Competitive advantages for New Zealand in biotech field pertaining to IP ownership/use?

Licensing issues faced

- Do you consider that patent landscape has become crowded/complex? Other thoughts on growth/complexity of patents filed in New Zealand?
- Patent searching – overly onerous, or simply a cost of doing business in the field? Have patent searching obligations increased over time?
- Effect of existing patents on choice of research
- Number of licenses generally needed to be negotiated to commence a project?
- Research not commenced due to patents – do patents indicate overly encumbered/crowded areas anyway and therefore not good areas for research?
- Research discontinued due to patents – has this happened before? Specific reasons for discontinuing? Positive or negative?
- Reach-through rights – common?

Commercialisation issues

- Royalty stacking – does this tend to have effect on research projects?

- Importance of patents for international business?
- Impact of GTG patents on business or patent searching/licensing practices?
- Research exemption – awareness of it among colleagues?
 - Does it play a role in decision-making on projects?

Appendix Four

Ethical approval form

Form devised May 1995; updated May 1997; June 1998; May 1999, Dec 2000, June 2002

ETHICAL APPROVAL AT DEPARTMENTAL LEVEL OF A PROPOSAL INVOLVING HUMAN PARTICIPANTS (CATEGORY B)

PLEASE read the important notes appended to this form before completing the sections below

NAME OF DEPARTMENT: Faculty of Law

TITLE OF PROJECT: Gene Patents in New Zealand

PROJECTED START DATE OF PROJECT: 1 May 2007

STAFF MEMBER RESPONSIBLE FOR PROJECT: Mark Henaghan

NAMES OF OTHER INVESTIGATORS OR INSTRUCTORS: Aphra Green (Research Fellow) and Richman Wee (Project Manager, Human Genome Research Project). Both staff members, but Aphra Green will also be undertaking her Masters in Law during the project.

BRIEF DESCRIPTION OF THE PROJECT: Please give a brief summary (approx. 200 words) of the nature of the proposal:-

The aim of this research is to investigate:

- the effects of gene patents on health and research organisations; and
- the involvement of New Zealand health and research organisation in genetic-based research, and the resulting patenting and licensing activity.

The particular research questions to be addressed by this research are:

- Are gene patents limiting access to healthcare by increasing the cost of diagnostic tests and treatment for certain diseases and/or limiting access to particular tests?
- Are gene patents inhibiting the free exchange of information and materials between researchers, and/or preventing or inhibiting particular research taking place?
- Are gene patents involving health and research organisations in extensive negotiations and/or costly legal battles, or requiring health and research organisations to expend resources searching for or assessing existing gene patents?
- To what extent are New Zealand health and research organisations participating in genetic-based research, and what patenting and licensing activity results from this research?

The methods by which the above questions will be addressed include:

- An online qualitative survey of people within organisations providing clinical diagnostic services and/or carrying out health research, and other interested parties; and
- Possible follow-up interviews with some survey participants and officials from relevant Government departments.

DETAILS OF ETHICAL ISSUES INVOLVED:

The main ethical issue identified was confidentiality of personal information. The names and positions of survey respondents will be collected as part of the online survey. However, survey participants are ensured in the survey that this information will remain confidential to the investigators and responsible staff members. Survey participants are also advised that in any subsequent reports or publications, answers that they give will be reported in a generalised manner (e.g. “the Scientific Director of a Biotechnology Company commented that...”).

Information provided by respondents to the online survey will be kept secure through the use of tamper-proof URLs and password-only access by the investigators to the survey reports.

ACTION TAKEN

- | | |
|---|--|
| <input type="checkbox"/> Approved by Head of Department | <input type="checkbox"/> Approved by Departmental Committee |
| <input type="checkbox"/> Referred to University of Otago Human Ethics Committee | <input type="checkbox"/> Referred to another Ethics Committee
Please specify: |

.....

DATE OF CONSIDERATION:

Signed (Head of Department):

Please attach copies of any Information Sheet and/or Consent Form

Appendix Five

Case studies: GTG and Myriad

As noted previously, policy action in this area has, in part, been stimulated by a few notable examples of patent enforcement by “outliers” in the biotechnology industry. Notwithstanding, it is worth undertaking a close examination of New Zealand’s own experience in this regard, with GTG.³¹⁷ New Zealand’s only experience with these issues was in 2003, when a number of organisations in the health and research sectors were approached by Genetic Technologies Ltd (GTG), who demanded large license fees for its patents on methods of analysis on non-coding DNA. Many aspects of the GTG patents and the other patents discussed in this chapter serve to illustrate the difficulties that have arisen in this area as a result of particular types of patents and licensing practices. This chapter discusses the GTG patents and Myriad Inc’s patents on the BRCA1 and 2 mutations.

GTG: the tip of the iceberg?

Genetic Technologies Ltd (GTG), an Australian Biotechnology Company, owns patents on non-coding DNA analysis and mapping. Non-coding DNA is used in diagnostic genetic testing and research in humans, animals and plants. GTG has an aggressive licensing strategy to collect royalties for their patents from genetic testing, research and commercial laboratories.³¹⁸ In 2003, GTG approached New Zealand health and research organisations, offering a licence to its patents. This chapter discusses:

- the GTG patents;
- GTG’s approach to New Zealand’s health and research organisations;
- the negotiations and final settlement with GTG; and
- broader public interest concerns and related work on the Patents Act review.

³¹⁷ This is the first time that much of this information has been made public and collected into a detailed narrative of this kind.

³¹⁸ The licensing business is one prong of a three-pronged business strategy, which also includes research and genetic testing.

What do the GTG patents cover?

Some genes code to a particular protein, which are critical in cellular development and other functions in the human body. However, approximately 98% of the human genome does not encode a protein. This non-coding DNA describes DNA that does not contain instructions for making proteins or other cell products. Non-coding DNA was initially termed “junk DNA”, since no function for it could be identified.³¹⁹ More recently, it has been found that non-coding DNA is a repository for a variety of functions, and “contains regulatory elements like enhancers, silencers of expression, and may function to promote exon shuffling in evolution”.³²⁰

While studying haplotypes³²¹ of the human major histocompatibility complex (MHC)³²², Dr Malcolm Simons discovered that non-coding DNA in the region of the MHC genes contained information having sufficiently “non-random sequence variation to be informative in individuals for surrogate typing of MHC genes”. That is, it appeared to code for something. In the case of Dr Simons’ MHC research, “the polymorphisms³²³ in the non-coding DNA were also informative of MHC haplotypes”.³²⁴ Dr Simons recognised that this discovery was likely to be universal, in that “the non-random, haplotypic structure of non-coding DNA would be a characteristic of the genomes of all eukaryotic organisms”.³²⁵ In other words, Dr Simons recognised that non-coding DNA in all eukaryotes would be a non-random indicator of the coding DNA, therefore giving an indication of haplotypes.

319 The phrase “junk DNA” is attributed to Dr Susumu Ohno (1928-2000). In 1972, in an attempt to explain the paradox that there was much more coding capacity in genomes than the number of genes, Dr Ohno proposed that much of the genome of more advanced eukaryotes was functionless. He called this DNA “garbage” or “junk” DNA. Discussed in C. Nottenburg and J. Sharples, “Analysis of “Junk DNA” Patents: Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes,” (2004).

320 Ibid.

321 A haplotype is the genetic constitution of an individual chromosome.

322 MHC encodes products critical for self-recognition and is useful in diagnostic tests (Nottenburg and Sharples, “Analysis of “Junk DNA” Patents: Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes.”).

323 A polymorphism is a genetic variation that occurs too frequently within a population to be a random mutation.

324 Nottenburg and Sharples, “Analysis of “Junk DNA” Patents: Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes.”

325 Ibid. Eukaryotes (or eukaryotic organisms) are organisms with complex cells, in which the genetic material is organized into membrane-bound nuclei. They include the animals, plants, and fungi, which are mostly multicellular, as well as the kingdom of the protists, many of which are unicellular.

When combined with amplification, markers found in non-coding DNA can be useful in predicting a number of diseases originating in the coding region, including Cystic Fibrosis, Duchenne Muscular Dystrophy, Haemophilia, Prothrombin (Factor II) and BRCA tests for the genes for breast cancer.

Dr Simons collaborated with Dr Mervyn Jacobson to establish GeneType AG, which was later acquired by a dormant public company in Australia which changed its name to Genetic Technologies Ltd.³²⁶ Dr Simons, with the backing of GeneType AG and Dr Mervyn Jacobson, applied for international patents for his inventions of the methods for analysing non-coding DNA. The patents were issued in New Zealand in 1992 and 1993.³²⁷ The equivalent US patents were issued in the United States in March 1993³²⁸ and August 1998³²⁹. The patents do not claim ownership of non-coding DNA itself, but claim methods for the analysis of the non-coding DNA. As put by Dr Jacobson, Director of GTG, "we didn't file any patents on gene sequences; we don't claim to own the sequence. We simply own a strategy for using information in the non-coding region that is linking to the coding allele or haplotype".³³⁰

The New Zealand patent "Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes" is substantially the same as the US version of the same patent. Nottenburg and Sharples have simplified the patent's claims:

- "a method for detection of at least one allele³³¹ of a gene
 - the gene is multi-allelic (has two or more variant sequences)
- first amplify genomic DNA using a primer pair that amplifies non-coding DNA
 - the non-coding DNA is genetically and physically linked to the gene
- then analyse the amplified DNA for a polymorphism

³²⁶ Kevin Davies and Mervyn Jacobson, "Conversation with Mervyn Jacobson: Playing by Aussie Rules," (Bio-IT World, 2003).. This reverse takeover was to facilitate fast-tracking onto the Australian stock exchange.

³²⁷ Simons, "Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes.", Simons, "Genomic Mapping Method by Direct Haplotyping Using Intron Sequence Analysis Variations."

³²⁸ Malcolm J. Simons, "Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes," (1993).

³²⁹ Malcolm Simons, "Human Leukocyte Antigen (H.L.A.) Locus-Specific Primers," (1998).

³³⁰ Davies and Jacobson, "Conversation with Mervyn Jacobson: Playing by Aussie Rules."

³³¹ "Allele" is defined within the patent document as a genetic variation associated with a coding region; an alternative form of the gene. "Allele" was further defined in the US patent application (in an amendment) as being associated with a change in an exon sequence rather than a change in the sequence of the encoded protein or in non-coding regions of the gene sequence.

- the polymorphism is indicative of a particular allele".³³²

GTG claims that these patents, which together might be called "uses of non-coding DNA for detecting alleles",³³³ essentially cover all uses of non-coding DNA to detect polymorphisms in human, animal and plant genetic testing and research applications. However, Nottenburg and Sharples note that "in contrast to the assertion that the patent claims all non-coding region polymorphism, the requirement in the claims for linkage of the two polymorphisms limits the scope of the patent".³³⁴ As outlined above, the link that must be made (according to Nottenburg's analysis of the patent) is between the non-coding and the coding DNA for the same polymorphism.

Dr Simons left GTG in 2000, and no longer owns any shares in GTG.³³⁵

The Approach

Early in 2003, GTG approached the Ministry of Health, district health boards and a number of Crown and private research institutions requesting licence fees for its patents on non-coding DNA. GTG initially requested from the Ministry of Health an upfront fee of \$10 million (for signing and waiving of past infringements nationally) and an annuity of \$2 million until 2011. If a national licence could not be achieved, GTG proposed to offer individual licences to each of the genetic testing laboratories in New Zealand.³³⁶ GTG had also offered individual licences to the other Crown and private research institutions that it approached.

These approaches were part of GTG's global licensing strategy to commercialise its non-coding DNA patents through an active licensing program. At the time of the New Zealand approach, a number of US and Australian research and biotechnology organisations had signed licenses with GTG, including³³⁷:

³³² Nottenburg and Sharples, "Analysis of "Junk DNA" Patents: Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes."

³³³ Ibid.

³³⁴ Ibid.

³³⁵ Kevin Davies, "Malcolm in the Middle," (Bio-IT World, 2003).

³³⁶ Ministry of Health, "Genetic Technologies Limited (G.T.G.) Patent Infringement Claim."

³³⁷ GTG website, "Issued licenses", <http://www.gtg.com.au/index.asp?menuid=060.170.020.020>, accessed 22 May 2007. Note that for many of the license agreements, there was other consideration in addition to up-front license fees. For example, GTG's license agreement with Myriad gave GTG the exclusive marketing rights in

- Nanogen (license announced April 2002) \$250,000
- Sequenom (license announced April 2002) \$500,000
- Perlegen Sciences (license announced September 2002) \$860,000
- Myriad Genetics (strategic alliance formed October 2002) \$1 million + marketing rights to genetic susceptibility tests for breast cancer
- Pyrosequencing (license announced March 2003) \$3 million
- Association of Regional and University Pathologists – owned by University of Utah (license announced March 2003) \$ 75,000
- University of Utah (research license announced May 2003) “nominal fee”
- Orchid Biosciences (cross-license announced May 2003) ~\$2.1 million
- Inguran (license announced June 2003) \$150,000

Because of the small number of licenses signed up to that point, and their relatively low value, it appeared that GTG was using New Zealand as a ‘test case’ to effectively confirm the validity of the patents.

At the time, GTG also made no secret of the fact that it had patent insurance, meaning that its insurers, a subsidiary of General Electric, would cover any litigation costs should their patents be challenged in Court.³³⁸ This meant that GTG’s requests for licence fees could take a stronger form. Dr Charles Cantor, Chief Scientific Officer of Sequenom, described it as:

*“...blackmail. It's that sort of threat aspect - "We're going to take you to court and it's going to cost you so much money to defend yourself that you're better off just paying us what we're asking for and we'll go away and you'll never hear from us again.”*³³⁹

Australia and New Zealand to Myriad’s tests for breast cancer, ovarian cancer, colon cancer, melanoma and hypertension.

³³⁸ Four Corners, "Patently a Problem: Transcript of Television Documentary."

³³⁹ Ibid.

Negotiations

Affected agencies in the health and research sectors in New Zealand came together under a formal agreement to negotiate as one entity with GTG, with Auckland District Health Board (ADHB) taking the lead for the health sector. The Ministry of Health and other Government agencies were also involved in the negotiations, mostly taking a 'watching brief' but also keeping relevant Ministers informed as required.

The negotiations with GTG, while carefully managed, were a difficult balancing of interests between the different parties. For example, ADHB faced competing interests in balancing 'public good' arguments, while also having to manage the negotiations and litigation within their funding baselines, and ultimately ensuring that the expectations of the Minister of Health were met. Under the Crown Research Institutes Act 1992, CRIs are required to "operate in a financially viable manner" (s5(2)). Faced with the possibility of expensive litigation, with the other side funded by patent insurance, one commentator put it, "It's better to pay".³⁴⁰ Another tension faced by many of the CRIs was the fact that many of the CRIs themselves hold patents, for which they might expect to get a return. Being involved in a challenge to the GTG patents might have appeared to undermine their own business practises, depending on the grounds for challenge.

The Ministry of Health, meanwhile, was responsible for supporting ADHB through the negotiation process, and providing policy advice to Ministers where necessary. The Ministry of Health also took a lead role in coordinating other Government departments and agencies to assist in the negotiation/litigation process.

During the negotiations, GTG granted individual licences to Ovita and Vialactia. Both Ovita and Vialactia agreed to pay a license fee and will pay royalties on future sales to GTG.³⁴¹

³⁴⁰ Robert Gottlieb, "Our Cut on DNA Research," *The Australian* 2003.

³⁴¹ Genetic Technologies Ltd website, <http://www.gtg.com.au/index.asp?menuid=060.170.020.020>, accessed 26 February 2007.

After many communications between the parties, ADHB filed proceedings against GTG for “unjustified threats” (under section 74 of the Patents Act), and then later filed revocation proceedings, seeking to have the patents revoked.³⁴²

Concerns regarding the patents

Clearly, issues regarding the interpretation of the patents can only be resolved by a Court. Thus far, any litigation with GTG has either been settled or won by GTG. Applera, a United States company which challenged the validity of GTG’s patents, settled with GTG after losing the initial or “Markman” hearings on every point raised.³⁴³ The total value of consideration received by GTG through Applera’s settlement with GTG was approximately A\$15 million (partly in cash and partly in kind).³⁴⁴

Some commentators have expressed concerns as to the breadth of the patents, or as to the breadth of GTG’s interpretation of its patents.³⁴⁵ As discussed in Appendix One, the breadth of patent rights that have previously been granted in relation to biotechnology and gene patents is of concern more generally, both nationally and internationally.

As noted above, Nottenburg considers that “the requirement in the claims for linkage of the two polymorphisms limits the scope of the patent”.³⁴⁶ However, GTG has given the impression that its patents cover any test involving amplification of non-coding DNA.³⁴⁷

However, despite divergent views as to the interpretation of the scope of the patent, the fact that the patent covers some form of analysis of non-coding DNA in **all** eukaryotic organisms (i.e. plants, animals, humans) is not in dispute. The application of the techniques in the

³⁴² McNabb, "Health Boards Deny Gene Test Claims."

³⁴³ Robert Gottlieb, "U.S. Genetics Win a Shot in the Arm," *The Australian* 2004..

³⁴⁴ Genetic Technologies Ltd, "Issued Licenses," (updated 21 February 2007)., Graeme O'Neill, "G.T.G. Celebrates Win over Applera," in *Australian Biotechnology News* (Bio-ITWorld.com, 2005).

³⁴⁵ Four Corners, "Patently a Problem: Transcript of Television Documentary.", Nottenburg and Sharples, "Analysis of "Junk DNA" Patents: Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes."

³⁴⁶ Nottenburg and Sharples, "Analysis of "Junk DNA" Patents: Intron Sequence Analysis Method for Detection of Adjacent and Remote Locus Alleles as Haplotypes."

³⁴⁷ Malcolm J. Simons, "'Junk DNA' Non-Coding Patents: The Inventor's View," (2004).

patent to all eukaryotes was supported during the patents' examination in the USPTO by declarations from experts in blood genetics, mouse genomics, and soybean plant genetics.³⁴⁸

One possible benefit of challenging the patents would be to have their interpretation narrowed. As Simons notes:

*“Scientific experimentation and patent claims are separate matters in that an inventor may claim a scope of the invention that extends beyond that of the performed scientific experiments. The objective of the Inventor’s Attorney is to compose the claims to achieve the widest possible scope, while avoiding interpretations that encompass prior art.”*³⁴⁹

This area would be a difficulty for GTG should the patents ever be challenged. GTG would seek to reinforce its broad interpretation, but doing so would have the danger of encompassing prior art.

There has also been some public speculation that the patent claims are not novel.³⁵⁰ In general, an invention will not normally be patentable if:

- it has been described in a publication, used, displayed or otherwise made available or commercialised in New Zealand before a patent is applied for;
- it is obvious compared to what is already known – it must involve doing something more than what would be obvious to a person skilled in the field; or
- it only combines two or more known products or processes, resulting in no new effect or improved results over what the products or processes previously achieved individually.³⁵¹

³⁴⁸ Ibid.

³⁴⁹ Ibid.

³⁵⁰ Peter Little, "Letters: G.T.G.'S Inventions Concerning 'Junk' DNA," (Bio-IT World, 2003).

³⁵¹ Intellectual Property Office of New Zealand, "Introduction to Patents."

The following four-step analysis has been adopted by New Zealand Courts in determining the issue of obviousness:

- “(1) identifying the **inventive** concept embodied in the claims;
- (2) assuming the perspective of an addressee normally skilled in the art in question, but unimaginative and "incapable of a scintilla of invention", and imputing to that person what was common general knowledge in the art at the priority date;
- (3) identifying what, if any, differences exist between the matters known or used at the priority date and the alleged invention; and
- (4) asking whether, viewed without any knowledge of the alleged invention, those differences constituted **steps** that would have been obvious to the skilled person, or whether they required a degree of invention.”³⁵²

The inventor, Dr Simons, has gone to some length to explain the US patents and to show why their claims are novel and inventive.³⁵³ Others have contended that the claims are not novel. Peter Little (an author of a paper claimed to be prior art) stated:

“It is unclear to me why, in 1989, it was necessary to prove the idea that linked polymorphisms could be used to analyse functional variation. The fundamental principles and practice had been widely published, and these could be simply applied to any gene, including the HLA complex. Importantly, the concepts of haplotypes, linkage disequilibrium, and linkage had all been identified as directly relevant to the DNA-based analyses then available.”

³⁵² Laws of New Zealand, "Patents and Inventions Vol I 46," (Lexis Nexis NZ Ltd, stated as at 1 March 2007).. See *Windsurfing International Inc v Tabur Marine (GB) Ltd* [1985] RPC 59 (CA) at 71, per Oliver LJ, followed in *Lucas v Peterson Portable Sawing Systems Ltd* [2006] 3 NZLR 721 (SCNZ), *Ancare New Zealand Ltd v Cyanamid of NZ Ltd* [2000] 3 NZLR 299 (CA) and *Smale v North Sails Ltd* [1991] 3 NZLR 19. See also *Van der Lely (C) NV v Ruston's Engineering Co Ltd* [1985] RPC 461 (CA) and *Procter & Gamble Co v Peaudouce (UK) Ltd* [1989] 1 FSR 180 (CA).

³⁵³ Simons, "'Junk DNA' Non-Coding Patents: The Inventor's View."

*GTG's contention that its principals had discovered something that was "largely overlooked" is not supported by the scientific literature. The comment that non-genic DNA is "a valuable and highly ordered reservoir of useful genetic information" is simply a restatement of what was first demonstrated in 1978 and applied widely. In this strict sense, such DNA can never be truly "junk" by virtue of its linkage to genes and must always be of potential utility.*³⁵⁴

Francis Collins has also expressed similar sentiments:

*"I personally find it surprising that the GTG patent was issued, given the requirements of the PTO's (U.S. Patent and Trademark Office's) novelty, non-obviousness, and utility standard. After all, there were many prior published reports on the correlation of variation in noncoding regions with important mutations, going back at least to Kan and Dozy's The Lancet report on the sickle mutation back in 1978."*³⁵⁵

The dispute as to the validity of the patents in relation to prior art and obviousness cannot be resolved here. In addition, there may be differences between the US patents and the New Zealand patents that could have a bearing on any prior art discussions.

As well as concerns regarding the validity of the patents themselves, Government officials held broader concerns as to the precedent effect that any negotiations or litigation with GTG might have. In particular, there was concern that "New Zealand would not want to be seen as a 'soft touch' when it comes to negotiating with patent holders in this area of increasing activity".³⁵⁶

A further complicating factor for Government officials was the lack of evidence of a widespread or emerging problem in relation to the licensing practices of other companies who held similar patents. The GTG patents may have been the first of many, or they may have been an aberration caused perhaps as a result of inexperience on the part of the New Zealand intellectual property office in the early 1990s. The Ministry of Health only had

³⁵⁴ Little, "Letters: G.T.G.'S Inventions Concerning 'Junk' DNA."

³⁵⁵ Collins et al., "A Patent's Place: Six Contrasting Views on the Noncoding DNA Patents and Business Strategy of Genetic Technologies."

³⁵⁶ Ministry of Health, "Genetic Technologies Ltd (G.T.G.) Patents - Update on Proposed Litigation."

anecdotal (and mainly overseas) evidence of potential problems with companies' licensing practices.³⁵⁷

Defining the public interest

The Ministry of Health and other Government departments faced the difficult task, throughout the negotiations, of defining the nature of the public interest in the case. Defining the public interest was likely complicated by:

- the competing interests of the parties faced with GTG's demands; and
- the Government policies that operated differently on those agencies to incentivise their particular behaviour.

For example, as discussed in section 2.2, the Government has produced many strategies and documents emphasising the importance of the biotechnology sector to the growth of the New Zealand economy. Clearly, commercialisation of the products of the biotechnology sector through capitalising on intellectual property is one aspect of this growth.

The dimensions to the public and Government interest in the proceedings were described in 2005 as including:

- the impact of patents of questionable validity on the research and healthcare sectors, and the potential for invalid patents to undermine the patent system, noting that a patent, even if valid, does not grant an absolute right to exploit an invention in any way an inventor chooses;

³⁵⁷ The most obvious case was the BRCA1 and BRCA2 patents, which Myriad Inc was aggressively enforcing in North America and Europe. However, Caulfield et al argue that policy activity in the area of gene patents "has been largely stimulated by a convergence of general social unease, the emergence of preliminary data and literature on the possible adverse practical ramifications of gene patents, and several high-profile patent protection controversies". See Caulfield et al., "Evidence and Anecdotes: An Analysis of Human Gene Patenting Controversies."

- that patent holders may not assert overly broad claims, and that ownership of a process does not confer rights over the physical material described in the patent claims;
- the signal sent to other patent holders regarding New Zealand's approach to questionable patents and its determination to ensure that such patents are subjected to close examination including the scrutiny of the courts if necessary;
- establishing case law around the parameters of patent law and the legal principles against which the validity of patents may be tested, noting that the Patents Act 1953 has a number of provisions available to protect the public interest that have not previously been invoked or tested;
- the number of New Zealand organisations affected or potentially affected, including a number of CRIs;
- possible negative 'chilling' effects on New Zealand's research and innovation potential.³⁵⁸

Cabinet agreed that challenging patents of questionable validity that may have an impact on research and healthcare sectors is in the public interest. Cabinet also agreed that the Crown entities involved in the litigation be asked to act in the Government's broader interests when considering settlement with GTG. To this end, the shareholding Ministers of the CRIs and the Minister of Health sent a letter to concerned parties outlining the Government's broad concerns for them to include in their consideration of any settlement options prior to mediation.³⁵⁹

³⁵⁸ Ministry of Health, "Cabinet Paper Pol (05) 142: Auckland District Health Board Litigation against Genetic Technologies Limited: The Broader Public Interest," (released in part under the Official Information Act 1982, 2005).

³⁵⁹ Ibid.

The Agreement

GTG and Auckland DHB (as representative of all New Zealand district health boards and New Zealand Blood Service) settled their dispute in June 2005. The settlement between GTG, ADHB and other affected life science organisations entailed:

- the withdrawal (without payment) of all High Court proceedings between the parties;
- an agreement from both parties not to pursue each other in future in relation to the patents; and
- an agreement to progress the option for GTG to provide laboratory services to ADHB in respect of breast cancer testing.³⁶⁰

As part of the same settlement, GTG granted a commercial licence to AgResearch, HortResearch, Forest Research, and Livestock Improvement Corporation for its foreign patents, for consideration of \$450,000.³⁶¹

The agreement does not concede the validity of GTG's patents, and nor does it contain a confidentiality clause.

GTG's strategic alliance with Myriad

As noted above, GTG formed a strategic alliance with Myriad Genetics Inc in October 2002, under which they agreed to "cross-license certain technologies related to the identification of non-coding DNA alterations and the assessment of inherited human diseases".³⁶² Under the terms of the agreement, Myriad received a broad, non-exclusive license to GTG's non-coding DNA patents for all applications in human therapeutics and diagnostics. In return, GTG became Myriad's exclusive marketing agent in Australia and New Zealand for its predictive medicine products, which include tests for breast cancer, ovarian cancer, colon cancer, hypertension and melanoma. It was agreed that GTG would perform the testing for breast and ovarian cancer (BRCA1 and BRCA2) at GTG's facilities in Melbourne, while all other

³⁶⁰ This part of the agreement appeared to later be the subject of slightly differing interpretations by the two parties. See McNabb, "Health Boards Deny Gene Test Claims."

³⁶¹ Ibid.

³⁶² Myriad Genetics website, <http://www.myriad.com/news/release/349733>, accessed 22 July 2007.

tests would be performed by Myriad at its facilities in the United States. Myriad granted GTG an option to perform the other tests in GTG's laboratories in Australia upon future payment of agreed fees and royalties.³⁶³

This alliance raised concerns both in New Zealand and in Australia. Subsequent to the Myriad-GTG alliance being announced, the Royal College of Pathologists of Australasia (RCPA) wrote to state and federal government departments in Australia expressing concern that GTG were seeking to enforce the Myriad patents on both breast cancer genes. The RCPA requested that urgent action be taken against the GTG patents, and identified the GTG non-coding patents as examples of patents on gene sequences that were unacceptable. In response to communications from GTG's attorneys, the RCPA sent out a "letter of clarification" to the departments that had originally received the letter. GTG were not satisfied with the letter as it "retracted certain minor issues but failed to retract the more serious misrepresentations contained within the original RCPA letter dated May 8th". The RCPA subsequently issued a public retraction of its earlier statements (8 July 2003).³⁶⁴ In New Zealand, the signing of this alliance was also noted with some concern by Government officials.³⁶⁵ Concerns surrounding GTG's patents and its strategic alliance with Myriad may have been one motivating factor in the Australian Government referring the issue of gene patenting to the Australian Law Reform Commission.³⁶⁶ GTG has emphasised that it does not intend to enforce the Myriad patents in Australia and New Zealand.³⁶⁷

Broader policy concerns

The concerns raised by GTG's approach, and broader concerns as to the implications of the granting of patents over genetic material lead to an issues paper being put to Cabinet in October 2003.³⁶⁸ Cabinet directed officials to report back to Cabinet Policy Committee with

³⁶³ Myriad Genetics website, <http://www.myriad.com/news/release/349733>, accessed 22 July 2007.

³⁶⁴ Genetic Technologies Ltd, "A Report to Shareholders: Genetic Technologies Ltd Obtains Retraction of Wrong Statements by the Royal College of Pathologists of Australasia," (<http://www.gtg.com.au/index.asp?menuid=060.070.130.010&artid=98>: 2003).

³⁶⁵ Ministry of Health, "Preliminary Advice on Effect of Gene Patents on Genetic Testing Services for Breast Cancer and Other Conditions," (obtained under the Official Information Act 1982, 6 November 2002).

³⁶⁶ Dianne Nicol, "Balancing Innovation and Access to Healthcare through the Patent System - an Australian Perspective," *Community Genetics*, no. 8 (2005).

³⁶⁷ Genetic Technologies Ltd, "A Report to Shareholders: Genetic Technologies Ltd Obtains Retraction of Wrong Statements by the Royal College of Pathologists of Australasia."

³⁶⁸ King and Tizard, "Implications of the Granting of Patents over Genetic Material."

recommendations on the issues and options for addressing genetic material patents. Cabinet agreed that the issues to be considered in that report-back would include:

- the moral and cultural issues raised by the grant of patents over genetic material, including concerns of Māori;
- the implications for research and innovation in this field of granting of patents over genetic material;
- the implications for the level and distribution of health costs and access to health care of such patents.

In their report-back³⁶⁹, officials recommended that:

- IPONZ consult widely in developing guidelines:
 - on the interpretation of the new Patents Act (once enacted);
 - for determining whether a commercial exploitation of a particular invention would be contrary to morality or *ordre public*;
- the Ministry of Economic Development:
 - carry out further policy work on the possibility of adding a research exemption to the Patents Act, and report back to Cabinet by the end of December 2004;
 - report back to Cabinet by 30 May 2005 describing progress on implementing the actions designed to allow more stringent application of the revised Patents Act when it comes into force; and progress made internationally towards finding mechanisms for narrowing the application of patents on genes;
- the Ministry of Health:
 - undertake further policy work on the implications for the public health system of patents over genetic materials and diagnostic tests and how these are licensed in the health sector, with a report back to Cabinet by 30 May 2005 on:

³⁶⁹ King and Tizard, "Memorandum to Cabinet Policy Committee: Report Back with Recommendations and Options for Addressing Genetic Material Patents."

- international developments in protecting public access to health care against abuse of monopoly power; and
- fiscal risks in the health sector resulting from the application of patents over genetic material;
- o investigate possible links with Australia with regards to monitoring the granting of patents over genetic material.

In May 2005, the Ministry of Health reported back to Cabinet on the fiscal risks of the licensing of genetic material patents in the health sector. The Ministry considered that:

- the level of fiscal risk associated with genetic material patents is generated by uncertainty surrounding the licensing practises of patent holders and by the quality of patents they are licensing;
- other than the GTG patents, other companies who own genetic material patents are not currently looking for licence fees from the New Zealand health sector, possibly due to the small size of the New Zealand market;
- increasing health sector spending on genetic testing and increasing demand for genetic testing may eventually result in increased spending on licences for patents;
- the lack of coordination across the district health boards in negotiating licenses or monitoring licence fees or terms could result in inequalities of royalties paid across district health boards, and increased royalties overall; and
- there was an argument for coordination between the district health boards in licensing such patents, though the Commerce Act implications of this would need consideration.³⁷⁰

Cabinet noted at that at that stage there was therefore no immediate need for new structures or policies to specifically address the licensing of genetic material patents. However, Cabinet agreed that the Ministry of Health take a leadership role and work with the Ministry of Economic Development and district health boards to educate the health sector about intellectual property issues including:

³⁷⁰ King, "Report Back to Cabinet Policy Committee on the Fiscal Risks of the Licensing of Genetic Material Patents in the Health Sector.", pp. 7-8

- workshops on changes to the new Patents Act (once enacted);
- the need for a coordinated approach when dealing with a patent holder;
- a process for investigating the content of the patent; and
- looking at whether to take a more active role in challenging patents at an early stage.³⁷¹

In February 2006, the Ministry of Economic Development published an options paper on the introduction of an explicit experimental use exception into New Zealand's patent legislation. After considering public submissions and further advice from officials, Cabinet agreed that the exception be incorporated into the new Patents Bill.³⁷² The experimental use exemption therefore arose directly from GTG's approach. The exemption and its likely impact is discussed below in section 8.1.3.

Myriad Genetics Inc

Myriad Genetics Inc is another genomics 'heavyweight', whose aggressive licensing tactics helped to raise the profile of concerns about patents on DNA.³⁷³ While Myriad hasn't enforced their patents in New Zealand, they have attempted to do so in Canada and Europe, and the policy debates that have ensued in those countries are similar to the ones that ensued following GTG's approaches in New Zealand. As Timothy Caulfield noted, "no other event has had as big an impact on the human gene patent debate in Canada as the decision by the US-based Myriad Genetics to take steps to enforce the patents on the BRCA1/2 genes".³⁷⁴ This section discusses the patents and the outcome of their enforcement by Myriad Genetics worldwide.

4.1.1 The BRCA patents

In October 1990, Mary-Claire King announced that she had narrowed the position of the BRCA1 gene down to a region on chromosome 17 containing about 1000 genes. This

³⁷¹ Ibid., p. 11.

³⁷² Tizard, "Cabinet Paper: An Experimental Use Exception for New Zealand's Patent Legislation."

³⁷³ See Caulfield et al., "Evidence and Anecdotes: An Analysis of Human Gene Patenting Controversies." for comment on the difficulty faced by policy makers in this area.

³⁷⁴ Caulfield, "Policy Conflicts: Gene Patents and Health Care in Canada."

announcement sparked a race between her team and a number of rival scientific teams to map the gene and to pinpoint the exact location of BRCA1.³⁷⁵ That race was ultimately won by Dr Mark Skolnick of Myriad Genetics, who were supported in their research by a large computer database of genealogies of Mormons living in Utah, which was linked to the Utah Cancer Registry. The linking of these two databases enabled Dr Skolnick to identify and study those families that had been affected by hereditary cancers, and who were therefore most likely to be able to help in pinpointing the BRCA gene.³⁷⁶

Myriad Genetics applied for, and received, disease gene patents on the BRCA1 gene³⁷⁷, and a “method of use” patent on the use of the BRCA1 gene in diagnostic and therapeutic testing.³⁷⁸ The abstract of the patents (the same in both), gives some idea of the breadth of the patents:

“The present invention relates generally to the field of human genetics. Specifically, the present invention relates to methods and materials used to isolate and detect a human breast and ovarian cancer predisposing gene (BRCA1), some mutant alleles of which cause susceptibility to cancer, in particular breast and ovarian cancer. More specifically, the invention relates to germline mutations in the BRCA1 gene and their use in the diagnosis of predisposition to breast and ovarian cancer. The present invention further relates to somatic mutations in the BRCA1 gene in human breast and ovarian cancer and their use in the diagnosis and prognosis of human breast and ovarian cancer. Additionally, the invention relates to somatic mutations in the BRCA1 gene in other human cancers and their use in the diagnosis and prognosis of human cancers. The invention also relates to the therapy of human cancers which have a mutation in the BRCA1 gene, including gene therapy, protein replacement therapy and protein mimetics. The invention further relates to the screening of drugs for cancer therapy. Finally, the invention relates to the screening of the BRCA1 gene for

³⁷⁵ Rimmer, "Myriad Genetics: Patent Law and Genetic Testing."

³⁷⁶ Ibid.

³⁷⁷ Donna M. Shattuck-Eidens et al., "Linked Breast and Ovarian Cancer Susceptibility Gene (Composition of Matter)," in <http://www.uspto.gov>, ed. United States Patent and Trademarks Office (United States of America: Myriad Genetics Inc, 1997).

³⁷⁸ Donna M. Shattuck-Eidens et al., "Linked Breast and Ovarian Cancer Susceptibility Gene (Method of Use)," in <http://www.uspto.gov>, ed. United States Patent and Trademarks Office (United States of America: Myriad Genetics Inc, 1998).

*mutations, which are useful for diagnosing the predisposition to breast and ovarian cancer.*³⁷⁹

While the patent does not claim the BRCA1 gene itself, its scope and broad drafting is such that the effect of the patent is to exclude others from use of the gene itself, without a license from Myriad.³⁸⁰

The BRCA2 gene, another breast and ovarian cancer predisposition gene, was discovered by a group at the Institute of Cancer Research in Surrey, lead by Professor Michael Stratton. The group had been collaborating with Dr Skolnick's team at Myriad, but due to Professor Stratton's concerns about Myriad seeking patents for both the BRCA1 and BRCA2 gene, ended the collaboration after publishing the location of the BRCA2 gene. Despite ending the collaboration and attempting to maintain secrecy prior to the publication of the discovery of the BRCA2 gene in *Nature*, Skolnick managed to obtain enough information to locate BRCA2 himself. Myriad submitted a patent application on BRCA2. In response, Stratton also submitted patent applications to protect the BRCA2 discovery from commercial exploitation. The British BRCA2 patent was awarded to the Cancer Research Campaign Technology and Duke University (who were also collaborating with Stratton).

This consortium granted an exclusive license to the patent for diagnostic services and products to OncorMed Inc. The terms of the license included broad sublicensing of the tests to other concerns, a requirement for counselling (before and after the tests), and a ban on direct-to-consumer advertising of the tests.³⁸¹

United States patents on BRCA2 were also issued to both Myriad³⁸² and the Cancer Research Campaign Technology consortium³⁸³. Again, Myriad's patents appear to be both

³⁷⁹ Ibid.

³⁸⁰ W R Cornish, M Llewelyn, and M Adcock, "Intellectual Property Rights and Genetics: A Study into the Impact and Management of Intellectual Property Rights within the Healthcare Sector," (Public Health Genetics Unit, Cambridge Knowledge Park, 2003), p. 45.

³⁸¹ Meredith Wadman, "Ethical Terms Set for Breast Cancer Test," *Nature* 390, no. 6658 (1997).

³⁸² Sean V. Tavtigian et al., "Chromosome 13-Linked Breast Cancer Susceptibility Gene," ed. United States Patent and Trademarks Office (United States of America: Myriad Genetics Inc, 1998).

³⁸³ Phillip Andrew Futreal et al., "Materials and Methods Relating to the Identification and Sequencing of the B.R.C.A.2 Cancer Susceptibility Gene and Uses Thereof," in <http://www.uspto.gov>, ed. United States Patent and Trademarks Office (United States of America: Duke University and Cancer Research Campaign Technology Ltd, 2002).

composition of matter and method of use patents, while Cancer Research Campaign Technology's only cover methods of use. Myriad and OncorMed issued patent violation proceedings against each other, but in a financial settlement, Myriad obtained exclusive rights to OncorMed's BRCA1 patents, and non-exclusive rights to its BRCA2 intellectual property, for use in Myriad's BRCAAnalysis genetic testing services. These rights applied only in the field of diagnostic testing services, while OncorMed retained its rights in relation to therapeutic applications of the patents.³⁸⁴

Since the issuance of its patents in the United States (and the securing of the OncorMed licence), Myriad now has an effective legal monopoly over genetic tests conducted using the BRCA genes in the United States and North America.

In Europe, the Institut Curie, the Institut Gustave Roussy, and the Assistance Publique-Hopitaux de Paris, with the explicit support of the French government and supported by other European organisations, have filed a succession of opposition proceedings against Myriad's BRCA1 patents, on grounds of:

- lack of priority and absence of novelty;
- lack of inventive step; and
- insufficient description.³⁸⁵

In addition, the Institut Curie argued that:

- all laboratories in Europe, regardless of the testing technique they use, could be prosecuted for patent infringement by Myriad, and would be obliged to send their BRCA tests to Myriad's "testing plant" in Salt Lake City, Utah, where all such tests would be performed";

³⁸⁴ Business Wire, "OncorMed Issued Second Patent for B.R.C.A.1 Gene," (<http://www.findarticles.com>, 28 May 1998).

³⁸⁵ Institut Curie, "Against Myriad Genetics' Monopoly on Tests for Predisposition to Breast and Ovarian Cancer Associated with the B.R.C.A.1 Gene."

- Myriad's monopoly on BRCA testing would lead to a loss of expertise and information among physicians and researchers in Europe, as they would be unable to carry out research to improve diagnostic technologies and methods;
- sending the samples to Utah would help Myriad build up a genetic databank of samples, thus granting Myriad "unchallenged control over the main research materials concerning genes coding for breast and ovarian cancer predisposition, thereby allowing it to make further discoveries" and potentially file further patents on those discoveries;³⁸⁶
- the loss of technical expertise by French and European laboratories in the area of family mutation searches would lead to a decrease in funding allocated to such laboratories, thereby having an impact on the ability of those labs to carry out basic research and having an impact on the future development of other preventive diagnostic techniques.³⁸⁷

The Institut Curie also argued that direct sequencing alone, the technique used by Myriad, is insufficient to detect all mutations, as 10-20% of all mutations go undetected using this technique.³⁸⁸

In May 2004, one of Myriad's European patents was totally revoked, and two others significantly limited in January 2005 by the EPO's Opposition Division. In particular, the principal claims over the gene itself and the essential points of the other claims were rejected on the basis that they did not comply with the European Patent Convention.³⁸⁹ The scope of a third Myriad patent was also significantly narrowed in June 2005.³⁹⁰

³⁸⁶ This issue is discussed further in section 2.5.2.

³⁸⁷ Institut Curie, "Against Myriad Genetics' Monopoly on Tests for Predisposition to Breast and Ovarian Cancer Associated with the B.R.C.A.1 Gene."

³⁸⁸ Ibid.

³⁸⁹ Institut Curie, "L'office Européen Maintient Le Brevet Sur Le Gène Brca2 Réduit À Une Mutation Particulière Et Sans Effet Bloquant Sur L'activité Des Laboratoires Européens," (<http://www.curie.fr/upload/presse/brca2-myriad-6-juil-05.pdf>: Institut Curie, 2005).

³⁹⁰ Ibid.

In March 2000, Myriad licensed MDS Laboratory Services (Toronto) to provide BRCA testing in Canada. Most samples were still sent to Myriad's facilities for the comprehensive BRCA analysis full-sequence test, though it was agreed that MDS would establish a service in Canada to provide individual mutation screening tests through its own network and relationships.³⁹¹ In May 2001, Myriad sent cease and desist letters to the eight Canadian provincial governments in Canada funding BRCA testing, alleging that the tests infringed Myriad's patents by using the patented gene.³⁹² Because Myriad's patents were disease gene patents, any test using the BRCA genes was arguably an infringement of their patents, even if the tests used different techniques.³⁹³ Myriad requested that tests be sent to their laboratory in Utah, at a cost of \$US3850 (in 2002), as compared with the costs to the Canadian provinces of Can\$1150 (in 2002).³⁹⁴ The responses of each of the provinces varied:

- Alberta and Manitoba continued their testing as before;
- British Columbia initially suspended its funding for the test, then referred patients to a research programme in Ontario, and is now funding a different test;³⁹⁵
- Saskatchewan, Newfoundland and Nova Scotia continued sending their samples to Ontario;
- Quebec complied with the order and began sending its samples to Utah
- Ontario announced that it would not comply with the order, that it would continue testing, and that it did not believe it was infringing the BRCA patents. Ontario subsequently announced that it would be adopting a new, cheaper and more accurate test that the one it had previously been using.³⁹⁶

It is not clear whether Myriad responded to this defiance, and if so, how. It is possible that Myriad was distracted by the formal challenge to its patents going on in Europe at the time.

³⁹¹ Myriad Genetics Inc, "Myriad Genetics Launches Molecular Diagnostic Testing in Canada," (9 March 2000).

³⁹² Garforth, "Health Care and Access to Patented Technologies."

³⁹³ Ibid.

³⁹⁴ Laura Eggertson, "Ontario Defies U.S. Firm's Genetic Patent, Continues Cancer Testing," *Canadian Medical Association Journal* 166, no. 4 (2002).

³⁹⁵ BC Ministry of Health Services, "Federal Leadership Urged as Genetic Testing Resumes," (14 February 2003).

³⁹⁶ Community Action, "Ontario Challenges Drug Patent - Offers Its Own Genetic Testing for Breast Cancer," (Find Articles, 20 January 2003).

One could speculate that Myriad realised that it was fighting a losing battle, both legally and in terms of popularity.³⁹⁷

In the United Kingdom, after protracted negotiations and much public and clinical opposition, Myriad reached an agreement with the National Health Service whereby the NHS would continue providing its BRCA testing services (using a variety of testing methods) without paying royalties or licensing fees to Myriad. Rosgen, a licensee of Myriad, agreed to provide the NHS with data on mutations it collected during private testing to improve the NHS's public testing services. Rosgen was allowed to continue providing the BRCA test privately to individuals who could afford the costs of the test or who had private insurance. Rosgen filed for voluntary liquidation in 2001, meaning that Myriad no longer has any presence in the United Kingdom. While Myriad could renegotiate with the NHS, to date it does not appear to have attempted to do so. However, in June 2007, Myriad announced that it had entered into a collaboration with AstraZeneca on Phase II trials of a new compound being tested to treat women with BRCA1/2 positive breast and ovarian cancer. The international, multi-centre trial is run by a British pharmaceutical company, KuDOS Pharmaceuticals³⁹⁸, and the Lead Investigator, Dr Andrew Tutt, is clinician scientist at the Breakthrough Breast Cancer Research Centre, also a British organisation.³⁹⁹ Myriad will provide molecular diagnostic testing for the trial.⁴⁰⁰

³⁹⁷ I would like to thank Dr Bitu Amani, Queen's University Faculty of Law, for reviewing the information summarised here on the enforcement of the BRCA patents in Canada and for also pointing out this article: Timothy Caulfield, Tania Bubela, and C J Murdoch, "Myriad and the Mass Media: The Covering of a Gene Patent Controversy," *Genetics in Medicine* 9, no. 12 (2007).

³⁹⁸ <http://www.kudospharma.co.uk/about/overview.htm>

³⁹⁹ <http://www.breakthrough.org.uk/index.html>

⁴⁰⁰ Myriad Genetics Inc, "Myriad Genetics Collaborates with Astrazeneca on Phase 2 Trials," (2007).

Appendix Six

History and development of the experimental use exemption

Many countries have some form of research exemption, whether codified or recognised in common law.

The earliest case in the United States to recognise that there may be a research use exemption was *Whittemore v Cutter*⁴⁰¹, in which Justice Joseph Story considered that the legislature could not have intended to punish those who constructed a patented invention “merely for philosophical experiments, or for the purpose of ascertaining the sufficiency” of the invention to produce its described effects.⁴⁰² Justice Story later recognised that profiting from the use of the invention would indicate infringement of the patent, whereas making “for the mere purpose of philosophical experiments, or to ascertain the verity and exactness of the specification” would attract an exemption from infringement.⁴⁰³ This distinction was also recognised in the common law jurisdiction in *Frearson v Loe*⁴⁰⁴:

*Patent rights were never granted to prevent persons of ingenuity exercising their talents in a fair way. But if there be neither using nor vending of the invention for profit, the mere making for the purpose of experiment, and not for a fraudulent purpose, ought not to be considered within the meaning of the prohibition, and if it were, it is certainly not the subject of an injunction.*⁴⁰⁵

⁴⁰¹ *Whittemore V Cutter*, 29 F. Cas. 1120 (1813).

⁴⁰² *Ibid.*, 1121. Richard Bee notes that: “The only explanation for the experimental use exception which seems to make any sense is that Justice Story, after a brief reflection on the matter, simply felt that the plain language of the statute [the Patent Act of 1793] could not have really been intended to cover the case of a man sitting at home in his parlor or basement workshop and tinkering around with a piece of apparatus as a ‘philosophical experiment’ and, hence, that this case should be simply an exception to the rights granted the patentee.” See Jordan P. Karp, “Experimental Use as Patent Infringement: The Impropriety of a Broad Exception,” *The Yale Law Journal* 100, no. 7 (1991), 2171.

⁴⁰³ *Sawin V. Guild*, 21 F. Cas. 554 (1813), 555, discussed in Karp, “Experimental Use as Patent Infringement: The Impropriety of a Broad Exception.”, p. 2171.

⁴⁰⁴ *Frearson V Loe*, 9 ChD. 48 (1878).

⁴⁰⁵ *Ibid.*, in Ministry of Economic Development, “An Experimental Use Exception for New Zealand’s Patent Legislation: An Options Paper,” (February 2006), p. 9.

By 1861, the “dilettante”⁴⁰⁶ uses of patented inventions (philosophical taste, curiosity, and mere amusement) were recognised as exceptions to an inventor’s usual exploitation rights.⁴⁰⁷ A number of later cases expanded on the dilettante exemptions, allowing for an “experimental use” exemption in some circumstances (where the use was more than for philosophical inquiry).⁴⁰⁸ Cases where an experimental use exemption was not allowed clearly had some aspect of commercialism or profit-making. For example, in *Spray Refrigeration Co. v. Sea Spray Fishing Inc.*⁴⁰⁹ the experimental use of a patented freezing method while on a commercial fishing operation constituted infringement, as did the production of a patented machine to be used for profit in *Bonsack Mach. Co. v Underwood*.⁴¹⁰

Despite being able to identify an authoritative line of cases, it can be said that the experimental use exemption has developed in a less than uniform manner. For example, in *Finney v. United States*⁴¹¹, a single experimental use of Finney’s invention by the National Aeronautics and Space Administration fell under the doctrine of *de minimus non curat lex*⁴¹² rather than an experimental use exemption. However, in *Deuterium Corp. v. United States*⁴¹³ the Claims Court, in finding that the exemption was inapplicable to infringement of a patented process on a pilot plant scale for the removal of hydrogen sulphide from geothermal steam, questioned “whether any infringing use can be *de minimis*. Damages for an extremely small infringing use may be *de minimis*, but infringement is not a question of degree”.⁴¹⁴

⁴⁰⁶ Janice M. Mueller, “No “Dilettante Affair”: Rethinking the Experimental Use Exception to Patent Infringement for Biomedical Research Tools,” *Washington Law Review* 76, no. 5 (2001).

⁴⁰⁷ *Poppenhusen v. Falke*, 19 Fed. Cas. 1048, 1049 (C.C.S.D.N.Y. 1861) (No. 11,279); in Jennifer Miller, “Sealing the Coffin on the Experimental Use Exception,” *Duke Law & Technology Review* 12 (2003).

⁴⁰⁸ See for example, *Ruth V. Stearns-Roger Manufacturing Co*, 13 F. Supp. 697 (1935). (experimental use exemption available to a company supplying mining and milling machinery to a non-profit institution); *Akro Agate Co. V. Master Marble Co.*, 18 F. Supp. 305 (1937).; (experimental testing of a patented machine for a brief period before commercial production of a different machine was not infringement); *Dugan V. Lear Avia*, 55 F. Supp. 223 (1944). (experimentally building a patented device but not manufacturing or selling it was not infringement); *Chesterfield V. United States*, 159 F. Supp. 371 (1958). (procuring a patented alloy for testing and experimental purposes was not infringement).

⁴⁰⁹ *Spray Refrigeration Co. V. Sea Spray Fishing, Inc.*, 322 F. 2d 34 (1963).

⁴¹⁰ *Bonsack Machinery Co. V. Underwood*, 37 F. 206 (1896).. See also *Sprout, Waldron & Co. V. Bauer Bros. Co.*, 26 F. Supp. 162 (1938). (experiments on commercial machines for profit in the ordinary course of business constituted infringement); *Northill Co. V. Danforth*, 51 F. Supp. 928 (1942). (experiments in connection with the manufacture and sale of patented anchors constituted infringement); *Deuterium Corp. V. United States*, 19 Cl. Ct. 624 (1990). (testing on a pilot plant scale of a patented process by the Department of Energy was infringement).

⁴¹¹ *Finney V. United States*, 178 U.S.P.Q. 235 (1973).

⁴¹² “The law does not care for, or take notice of, very small or trifling matters.”

⁴¹³ *Deuterium Corp. V. United States*, 14 U.S.P.Q. 2d 1636 (1976).

⁴¹⁴ *Ibid.*, 1642.

An early case recognised that there may be an experimental use exemption for academic use of patented inventions, but again it is difficult to reconcile this case with other formulations of the exemption. In *Ruth v Stearns-Roger Manufacturing Co.*, the defendant sold parts of patented flotation devices to customers, including the Colorado School of Mines. The Court found the defendant liable for contributory patent infringement for the sale of the flotation devices, but exempted the sales to the School of Mines because the devices were used to conduct research, and no financial gain was made from the use of the patented invention (by the School). Clearly however, the defendant did make some financial gains from their original sale to the school.⁴¹⁵ It is submitted that this case is somewhat of an anomaly among the rest, as it allows an exemption for products sold to an educational institution, even though financial gains would have been made from their sale by the alleged infringer. This case has effectively been overruled by *Madey v Duke* (discussed further below).

To summarise, the experimental use exemption as developed over the nineteenth and early twentieth centuries, has applied where the alleged infringement:

- was carried out in the context of non-commercial experimentation;
- was conducted on a small-scale;
- did not cause economic injury to the patent-holder; and
- brought no economic gain to the infringer.⁴¹⁶

United States

Three recent cases in the United States have clarified and narrowed this exemption. Cases involving pharmaceutical patents, both overseas and in New Zealand, have resulted in 'safe harbour' or 'springboarding' provisions being provided for in legislation. This is the second type of research exemption identified above, and in the United States was the result of legislative reaction to *Roche Products Inc. v Bolar Pharmaceutical Co.*⁴¹⁷ In *Roche*, Bolar Pharmaceuticals sought to introduce a generic version of Roche's Flurazepam HCl immediately on expiration of Roche's patent. To do this, Bolar needed to carry out extensive

⁴¹⁵ *Ruth V. Stearns-Roger Manufacturing Co.*

⁴¹⁶ Caruso, "The Experimental Use Exception: An Experimentalist's View."

⁴¹⁷ 733 F. 2d 858; 221 USPQ 937 (Fed.Cir. 1984).

testing of the composition to supply data to the US Food and Drug Administration for approval. Satisfying the FDA requirements as early as possible meant that Bolar could have a generic version on the market almost immediately on the expiry of Roche's patent. Bolar imported the patented drug into the United States, and conducted the necessary testing and investigation. Roche sued to prevent this activity, arguing that the importation and use by Bolar of the substance constituted infringement. The district court held that Bolar's "limited use of a patented drug for testing and investigation strictly related to FDA drug approval requirements during the last [six] months of the term of the patent" did not constitute actionable infringement.⁴¹⁸ This decision was overturned on appeal however, with the Federal Circuit noting that "section 271(a) prohibits, on its face, any and all uses of a patented invention".⁴¹⁹ As noted above, this decision resulted in the introduction of the Drug Price Competition and Patent Term Restoration Act 1984, discussed further below.

In *Embrex, Inc. v. Service Engineering Corp*⁴²⁰ the Federal Circuit upheld the district court's finding of wilful infringement, where Service Engineering Corp (in violation of an earlier settlement agreement) had its scientists test a prototype machine for conducting *in ovo* inoculations of poultry in violation of a patent claiming this method of immunising poultry against particular diseases. The Court reinforced its decision in *Deuterium Corp*, noting that "since its inception, this court has not tolerated the notion that a little infringement – de minimis infringement – is acceptable infringement or not infringement at all."⁴²¹ The Court entertained the possibility that the very narrow experimental use exemption may retain "some lingering vitality", though "the slightest commercial implication will render the 'philosophical inquiry/experimental use' doctrine inapplicable".⁴²²

The Court of Appeals for the Federal Circuit subsequently had the opportunity to examine the application of the exemption to non-profit institutions. In *Madey v Duke*,⁴²³ Dr Madey, an ex-employee of Duke University, brought infringement proceedings against Duke University for the use of various laboratory equipment developed and patented by Madey. The District

⁴¹⁸ *Roche Products Inc V. Bolar Pharm. Co.*, 733 F. 2d 858 (1984), *Roche Products Inc V. Bolar Pharm. Co.*, 221 USPQ 937 (1984).

⁴¹⁹ *Roche Products Inc V. Bolar Pharm. Co.*, 860.

⁴²⁰ *Embrex Inc V. Service Engineering Corp.*, 216 F. 3d 1343 (2000).

⁴²¹ *Ibid.*, 1350.

⁴²² *Ibid.*, 1352.

⁴²³ *Madey V. Duke*, 307 F. 3d 1351 (2002).

Court, applying *Ruth*, considered that the experimental use defence covered uses that were solely for research, academic, experimental, and non-profit purposes.⁴²⁴ Given the emphasis in earlier and more recent cases on the need for some aspect of commercial advantage being derived from the use of an invention, this was arguably a reasonable conclusion. However, the Court of Appeals for the Federal Circuit considered the *Ruth* case to have been overruled by *Embrex, Roche, and Pitcairn v. United States*⁴²⁵ but recognised that the *Ruth* case represented “the conceptual dilemma that may have led the district court astray”.⁴²⁶ The Court held that the experimental use exemption applies only where the patented invention is used solely “for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry”, and that the exemption does not apply if the use is “in furtherance of the alleged infringer’s legitimate business”. The Court considered that the precedents did “not immunize any conduct that is in keeping with the alleged infringer’s legitimate business, regardless of commercial implications”, noting that the equipment was used by Duke to further its legitimate business objectives, even though many projects undertaken by universities have no commercial outcome whatsoever, “including educating ... students and faculty participating in these projects. These projects also serve, for example, to increase the status of the institution and lure lucrative research grants, students and faculty.”⁴²⁷

In the United States therefore, the research exemption has been narrowed almost out of existence. Many have argued for the research exemption to be broadened⁴²⁸ and/or codified⁴²⁹, but so far these arguments have gone unanswered by legislators. In particular, many argue that the court-defined narrow research exemption is out of step with current research practice:

“It is urged that a narrow experimental use exception is at odds with both the constitutional mandate that grounds patent law and with current practice among researchers worldwide whose conduct generally suggests a misplaced, but fervent,

⁴²⁴ *Embrex Inc V. Service Engineering Corp.*, 1361.

⁴²⁵ *Pitcairn V. United States*, 547 F. 2d 1106 (1976).

⁴²⁶ *Madey V. Duke.*, 1362.

⁴²⁷ *Ibid.*, 1362.

⁴²⁸ Caruso, "The Experimental Use Exception: An Experimentalist's View."; Miller, "Sealing the Coffin on the Experimental Use Exception." **need more references here**

⁴²⁹ Mueller, "No "Dilettante Affair": Rethinking the Experimental Use Exception to Patent Infringement for Biomedical Research Tools." **need more references here**

*belief that non-commercial or pre-commercial infringement carried out in the interests of scientific research is always excused.*⁴³⁰

This argument has also been borne out in findings by Walsh et al and Nicol and Nielsen, who found that university researchers did not routinely search for, or ignored, relevant patents because of a misconceived notion that they were protected by a research exemption.⁴³¹ It must be recognised however, that universities and other non-profit research institutions face a much smaller risk of infringement proceedings because of the public relations difficulties that such proceedings would cause the patent holders.⁴³² Even if such litigation were successful, the quantum of damages awarded is likely to be minimal where the institution is not making commercial gains from such research.

However, research licenses are beginning to become more common as patentees seek to maximise the commercial gains from their patents. In particular, GTG and Myriad have become somewhat notorious for seeking research licenses from universities and other non-profit research institutions. Miami Children's Hospital and DuPont have also aggressively asserted their research tool patents against research organisations.⁴³³ Walsh et al consider that one reason for this is that neither of these two organisations are part of the biotechnology community, and they therefore have no goodwill to lose (and revenue to gain) by enforcing their patents.⁴³⁴ This is less the case for GTG and Myriad, who remain involved in research and collaborations in the wider biotechnology community.

⁴³⁰ Caruso, "The Experimental Use Exception: An Experimentalist's View."

⁴³¹ Nicol and Nielsen, "Patents and Medical Biotechnology: An Empirical Analysis of Issues Facing the Australian Industry.", pp. 178-180. Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation.", pp. 324-326.

⁴³² However, this concern has not prevented GTG from enforcing its patents against universities and other non-profit research and organizations in Australasia.

⁴³³ Miami Children's Hospital was charging \$12 per test for Canavan's disease, which was considered high. DuPont began asserting its exclusively licensed OncoMouse patent against universities that did not follow the precise terms of a prior memorandum of understanding between DuPont and the National Institutes of Health for use of the OncoMouse patent. Walsh, Arora, and Cohen, "Effects of Research Tool Patents and Licensing on Biomedical Innovation.", p. 326.

⁴³⁴ *Ibid.*, p. 326.

Europe

In Europe, the Community Patent Convention was enacted in 1975 in order to standardise a number of the rules governing European Community patents. The Convention has never come into force, but has had an impact on the coherence of a European experimental use exemption. All countries in Europe, with the exception of Austria, have codified experimental use exemptions which reflect the exemption found in the Community Patent Convention.

In the Convention, Article 31 specifies that patent protection does not extend to:

- acts done privately and for **non-commercial purposes**; and
- acts **done for experimental purposes relating to the subject matter of the invention**,⁴³⁵

Uniformly worded exemptions are found in United Kingdom, German and French legislation. However, interpretation of the exemption has differed across these three countries, with the variation depending on jurisprudential construction of the patent claims. The general interpretation of the European research exemption is that the exemption permits experimentation on the subject matter of the patent but does not extend to experimentation *with* the subject matter of the patent.

Australia

As noted above, *Frearson v Loe* is the authority for an experimental use exemption in Australia and New Zealand. This case recognised that there may be an exemption for use of an invention where there is no commercial purpose.⁴³⁶ There have been no further cases in Australia, though it is often presumed that a research exemption exists for non-profit research.⁴³⁷ The Australian Law Reform Commission recommended in 2004 that an experimental use exemption be incorporated into the Australian Patents Act 1990. The ALRC

⁴³⁵ European Union Community Patent Convention, Article 31. This exemption is reflected in the United Kingdom Patents Act 1977, section 60.

⁴³⁶ *Frearson V Loe*.

⁴³⁷ Australian Law Reform Commission, "Genes and Ingenuity: Gene Patenting and Human Health.", pp. 318-319.

recommended that the exemption take the form of the European Community exemption and protect experimentation on the subject matter of the patented invention, rather than use of the patented invention for other aims. This would protect research aiming to discover more about the invention and its properties.⁴³⁸ The Australian Advisory Council on Intellectual Property (ACIP) consulted on the experimental use exemption⁴³⁹, and in October 2005, recommended that the Patents Act 1990 be amended to include the following exemption:

The rights of a patentee are not infringed by acts done for experimental purposes relating to the subject matter of the invention that do not unreasonably conflict with the normal exploitation of a patent.

Acts done for experimental purposes relating to the subject matter of the invention include:

- *determining how the invention works;*
- *determining the scope of the invention;*
- *determining the validity of the claims;*
- *seeking an improvement to the invention.*⁴⁴⁰

ACIP also recommended that additional guidance be included in the Explanatory Memorandum to the above amendment, "explaining that the purpose of the exemption is to encourage the further development of patented fields of technology without unfairly devaluing patent rights or breaching the TRIPS Agreement, and that the exemption is not intended to derogate from any other exemption from infringement that exists under the Act."⁴⁴¹ The Australian Government accepted these recommendations, and will introduce legislation to amend the Patents Act 1990.⁴⁴²

⁴³⁸ Ibid., p. 318.

⁴³⁹ Advisory Council on Intellectual Property, "Patents and Experimental Use: Options Paper," (2004).

⁴⁴⁰ Advisory Council on Intellectual Property, "Patents and Experimental Use," (2005), p. 5.

⁴⁴¹ Ibid., p. 5.

⁴⁴² IP Australia, "Australian Government Response to the Advisory Council on Intellectual Property Report Patents and Experimental Use," (2007), p. 2. Bob Baldwin, "New Laws Ensure More Freedom for Australian Innovators," ed. IP Australia (Parliamentary Secretary to the Minister for Industry, Tourism and Resources, 6 August 2007).

New Zealand

In New Zealand, the experimental use exemption was considered by Justice Eichelbaum in *Monsanto Co. v Stauffer Chemical Co.*⁴⁴³ In that case, Monsanto had obtained New Zealand and worldwide patent protection on a chemical marketed as Roundup (a weed killer). Stauffer commenced field trials of a similar product in New Zealand. At an interim hearing, Justice Eichelbaum considered whether there was a serious question to be tried in relation to Stauffer's alleged infringement of Monsanto's patent on the active ingredient in Roundup. However, since Stauffer's use of the product in New Zealand was only at a field trial level, Eichelbaum also considered whether the use could be classed as 'experimental' and therefore exempted from infringing the patent. After reviewing the relevant case law⁴⁴⁴ and the character of Stauffer's behaviour, Eichelbaum concluded that

*When the defendant's use of SC 0224 in field trials in New Zealand is considered in this light of these cases they all appear to me to point in the direction that the defendants have gone well past the demarcation line of permitted experimental use. Indeed I think Mr Gault has a persuasive point when he says that having regard to the stage to which the first defendant [Stauffer UK] has taken the development of SC 0224, that is to say to the stage where in the UK it was in a position to launch it on the market commercially, the time when the defendants may have been regarded as carrying out experiments of the permitted type must have long gone by.*⁴⁴⁵

What can be derived from this case (and the cases reviewed by Justice Eichelbaum therein), is that a common law experimental use exemption does exist in New Zealand, but that exemption is difficult to define and has not been considered in the context of research by non-profit institutions. Essentially an exemption likely exists for experiments done **on** an invention with the intention of improving it or finding out more about it, and those experiments do not constitute infringement *provided that* there is absolutely no object of making a profit or using the invention in trade, or deriving a commercial advantage of some kind.

⁴⁴³ *Monsanto Co V Stauffer Chemical Co*, 1 TCLR 129 (1984).

⁴⁴⁴ *Frearson V Loe.*; *Pfizer Corp V Ministry of Health*, RPC 261 (1965).; *Molins & Molins Machine Co Ltd V Industrial Machine Co Ltd*, 54 RPC 94 (1936).; *Dunlop Pneumatic Tyre Co V British and Colonial Motor Car Co Ltd*, 18 RPC 313 (1901).; *United Telephone Co V Sharples*, 29 Ch D 164 (1885).; *Proctor V Bayley & Son*, 6 RPC 106 (1888)..

⁴⁴⁵ *Monsanto V Stauffer Chemical.*, 144.

The experimental use exemption was further considered in *Smith Kline & French Laboratories Ltd v Attorney-General*.⁴⁴⁶ This case is similar to *Roche v Bolar* in that it dealt with the question of whether importation of a pharmaceutical for the purposes of conducting experiments to gain marketing approval was an infringing 'use' of the invention. Judge Hardie Boys also recognised the difficulty in delineating the distinction between 'use' and 'experimental use':

*Doubtless experimentation will usually have an ultimate commercial objective; where it ends and infringement begins must often be a matter of degree. If the person concerned keeps his activities to himself, and does no more than further his own knowledge or skill, even though commercial advantage may be his final goal, he does not infringe. But if he goes beyond that, and uses the invention or makes it available to others, in a way that serves to advance him in the actual market place, then he infringes, for the market place is the sole preserve of the patentee.*⁴⁴⁷

In this case, Douglas Pharmaceuticals had imported samples of a generic pharmaceutical while the pharmaceutical was still under patent in New Zealand to Smith Kline. Douglas supplied a sample of the pharmaceutical to the Ministry of Health in anticipation of gaining consent to market it in New Zealand. In holding that these actions constituted an infringement of Smith Kline's patent, President Cooke considered that:

as a matter of the ordinary use of language ... to send an embodiment of the invention to a government authority for approval is plainly a use of it. Without doubt, too, Douglas acted for the commercial advantage or springboard of being more ready to launch into the market when the patent expired. This seems to me an infringement of both the letter and the spirit of the grant. Indeed, whenever obtained, statutory marketing approval is a form of licence and prima facie has commercial value.

⁴⁴⁶ *Smith Kline & French Laboratories Ltd V Attorney-General*, 4 TCLR 199 (1991).

⁴⁴⁷ *Ibid.*, 8.

The New Zealand Government later made an amendment to the Patents Act 1953 to clarify that the use of an invention for regulatory review purposes is not an infringement (section 68B). This section is discussed further below.

Safe harbour or regulatory review exception

United States

As noted above, the decision in *Roche* resulted in the enactment of the Drug Price Competition and Patent Term Restoration Act 1984, introduced by Senators Hatch and Waxman (and therefore usually referred to as the Hatch-Waxman Act). This Act had two aims:

- to pharmaceutical manufacturers to make, use, offer to sell, or sell a patented invention for the purposes of developing and submitting the information necessary for the generic pharmaceutical to be approved by US regulators (such as the FDA).⁴⁴⁸

Under the provisions of the Hatch-Waxman Act and the Abbreviated New Drug Application (ANDA) process, generic manufacturers need only show that the generic drug is the bioequivalent of the brand-name drug. However, upon application, generic manufacturers must certify that the patent is not valid or is not being infringed. Notification of the generic application will then be sent to the patent-holder, who has 45 days in which to file infringement proceedings against the generic manufacturer. The ANDA application is then automatically put on hold for 30 months, allowing time for the litigation to be settled or fought out. This 30-month stay effectively provides an advantage to the original patent-holder, allowing for two more years of market exclusivity, during which time the profits from the sales of the drug outweigh the litigation costs.⁴⁴⁹ Another way for companies to delay the entry of

⁴⁴⁸ 35 U.S.C. 271(e)(1)

⁴⁴⁹ Sarah E. Eurek, "Hatch-Waxman Reform and Accelerated Market Entry of Generic Drugs: Is Faster Necessarily Better?" *Duke Law & Technology Review* 18 (2003).. See for example, *In re Gabapentin Patent* (Fed. Cir. 2007), in which Warner Lambert Pharmaceuticals filed infringement proceedings against generic manufacturer Teva, who in the District Court was granted summary judgment of non-infringement, considering that the evidence was insufficiently precise to prove infringement. On appeal the Court of Appeals for the Federal Circuit reversed the summary judgment, saying that the District Court had been hasty in discounting Warner Lambert's expert witness evidence that the acidic content of the samples fell within the scope of the claims. A jury will now decide whether Teva and other generic manufacturers selling the drug containing

generics onto the market is to make multiple patent listings of related compounds in the FDA's Orange Book, which is the official listing of approved products. If the patents are listed in the Orange Book after a generic manufacturer has submitted its first ANDA application for one substance, the patentee must be re-notified about ANDA applications for the related patents, meaning that the 30-month stay can be used for these patents also.

There has been very little litigation in the United States on the wording of the safe harbour provisions themselves. However, as noted above, there is some evidence that pharmaceutical companies are using the ANDA process and "later-listings" to their advantage to delay the entry of generics onto the market.⁴⁵⁰

New Zealand

In New Zealand, the regulatory review exception was introduced to the Patents Act 1953 in 2002. Section 68B states that:

*It is not an infringement of a patent for a person to make, use, exercise, or vend the invention concerned solely for uses reasonably related to the development and submission of information required under New Zealand law or the law of any other country that regulates the manufacture, construction, use, or sale of any product.*⁴⁵¹

A World Trade Organisation Panel, examining the identical Canadian provision, held that the provision was consistent with Canada's obligations under the TRIPS agreement.⁴⁵²

gabapentin have infringed, as unusually, the generic manufacturers have been selling gabapentin since 2004. *In Re Gabapentin Patent*, (2007).

⁴⁵⁰ Eureka, "Hatch-Waxman Reform and Accelerated Market Entry of Generic Drugs: Is Faster Necessarily Better?"

⁴⁵¹ This exemption is identical to section 55.2(1) of the Canadian Patent Act.

⁴⁵² However, an exception which allowed Canada's generic manufacturers to manufacture and accumulate the generic product during the last six months of the patent term was held not to be consistent with Canada's obligations under TRIPS: World Trade Organisation, *Canada - Patent Protection of Pharmaceutical Products* (2000 [cited 17 August 2007]); available from http://www.wto.org/english/tratop_e/dispu_e/cases_e/ds114_e.htm.; Sylvie Bussieres, *Canada Welcomes W.T.O. Ruling on E.U. Challenge of Canada's Pharmaceutical Patent Regime* (2000 [cited 17 August 2007]; available from http://w01.international.gc.ca/minpub/PublicationContentOnly.asp?publication_id=377555&Language=E&MODE=CONTENTONLY&Local=False).

Europe

As outlined above, the experimental use exemption in the Community Patent Convention has been incorporated into the law of almost all European States. However, the interpretation of those exemptions is left to the courts of each country. In general, the experimental use exemption has not been interpreted as protecting acts undertaken to satisfy regulatory requirements.⁴⁵³

⁴⁵³ For example, neither Germany nor the United Kingdom has codified regulatory review exemptions, and courts in both countries have held that their respective research exemptions did not cover acts undertaken to satisfy regulatory requirements. However, France has a statutory regulatory review exception, which allows a marketing authorization for a generic pharmaceutical to be granted prior to the expiry of a patent (though actual marketing cannot take place until expiry). Centre for Intellectual Property and the Health Law Institute, "The Research or Experimental Use Exemption: A Comparative Analysis.", p. 22-26.