THE ROYAL SOCIETY OF NEW ZEALAND

PROGRESS AND ACHIEVEMENTS REPORT

INCORPORATING THE MARSDEN FUND COUNCIL REPORT ON THE MARSDEN FUND

NOVEMBER 2006

Promoting excellence in science and technology

TABLE OF CONTENTS

RSNZ – Our Activities....2
RSNZ – Our direction....4
Output Class 1 - Research Contract Management (except the Marsden Fund)....11
Output Class 2 - Research Contract Management of the Marsden Fund....14
Output Class 3 - Marsden Fund....16
The Impact of the Marsden Fund on the Wellbeing of New Zealanders....19
Output Class 4 - Supporting Promising Individuals....35
James Cook Research Fellowships....35
NZ Science, Mathematics and technology Teacher Fellowships....38
Talented School Students Travel Award....40
Output Class 5 - International Science and Technology Linkages....41
Bilateral Research Activities Programme....41
Output Class 6 - Promoting Science and Technology....44
Communication of Science....44
Young Achievers....45
The Societies own activities in Education – inspiring our younger generations....47
Output Class 7 - Journal Publications by The Royal Society of New Zealand....49
Output Class 8 - Other International Activities....52

RSNZ – OUR ACTIVITIES

This progress and achievement report covers the Royal Society's activities in the 2005/06 financial year that are funded by Government (Vote RS&T). These are:

Awareness and Communications
- World Year of Physics activities
- Radio New Zealand collaboration

Education – inspiring our younger generations
- Teacher Fellowships
- Young Achievers database
- CREST Awards promoting creativity in science and technology projects[1,2]
- National Waterways Programme – EMAP[1]
- Talented School Student Travel Award
- BAYERboost short environmental scholarships for students
- Genesis Realise the Dream[2]
- International exchanges for students[2]
- Publications for young people – publishing Alphas and Gammas

Expert Advice
- Committees
- Policy Unit
- Science Meets Parliament – The Speaker's Science Forum

Supporting Excellence
- Marsden Fund,
- James Cook Research Fellowships

Supporting the Profession
- Publishing the eight New Zealand scientific journals
- Promoting open access and digital archives of journal publications
- Support for our 70 constituent science organisations, affiliates and branches
- Newsletters and daily news for scientists and technologists
- Medals, national awards event and professional science week
- Promoting a Code of Professional Standards and Ethics for researchers
- Communications courses for scientists to business and general audiences

International Activities
- ISAT Fund - Bilateral Research Activities Programme
- International Conference Fund
- Membership of international scientific unions
- Co-Lab website to support NZ Science Counsellors in Brussels and Washington

[1] Supported by the Ministry of Education
[2] Partial funding

HOW OUR ACTIVITIES MATCH MORST'S PRIORITIES

MoRST Priorities	Relevant RSNZ activities
Develop a national research agenda	National Science Panel Science Meets Parliament – The Speaker's Science Forum
Provide science roadmaps in necessary areas	Submissions made to Energy and Biotech roadmaps
Targeted work to improve researcher and end-user links	Communications courses for scientists to business audiences Developing Leaders programme with NZTE
Emerging S&T scan	Worked with Network Navigator
Linking school students and families with NZ research	Teacher Fellowships CREST Awards promoting creativity in science and technology projects BAYERboost short environmental scholarships for senior secondary and undergraduate students Young Achievers database Alpha publication
Communication messages to demonstrate value of S&T	World Year of Physics activities BIG Science Adventures schools video competition Radio New Zealand collaboration VIP science classes for journalists and artists Are Angels OK? Project Popular science publishing "Elegant Universe of Albert Einstein" and "Are Angels OK?" books Distinguished Speakers series BP Challenge Genesis Realise the Dream National Waterways Programme - EMAP Talented School Student Travel Award genETHICS International exchanges for students Publications for young people – publishing Alphas and Gammas, and distributing Helix and Scientriffic Medals, Science Honours Dinner national awards event and professional science week Annual conference Communications courses for scientists to general audiences
Access to international and local research expertise	ISAT Fund - Bilateral Research Activities Programme International Conference Fund Membership of international scientific unions
Increase participation in co-funded research	Co-Lab website to support NZ Science Counsellors in Brussels and Washington
More effective and stable funding system	Provided policy papers on longer term investment and stable funding Conference support for young professionals Newsletters and daily news for scientists and technologists
Rationalise RS&T and Education Votes	Working with MinEdu on Olympiads and environmental awareness
Attracting and retaining the best people in our science system	Marsden Fund James Cook Research Fellowships
Investment in our science "backbone" of infrastructure and equipment	Publishing the eight New Zealand scientific journals Promoting a Code of Professional Standards and Ethics for researchers Promoting open access and digital archives of journal publications Support for our 70 constituent science organisations, affiliates and branches EMAP

RSNZ – OUR DIRECTION

OUR VISION FOR NEW ZEALAND'S FUTURE

We will work towards a New Zealand where research, science and technology underpin our economic, environmental and social wealth. We believe this will require more investment in science and a balance struck between directing research to national needs and supporting researcher's own visions of future directions.

We will work towards a New Zealand where society is fully engaged with the research system. This will require the science system tell the story of science in a much more engaging manner.

We will work towards a New Zealand where industry is fully engaged with the research system where industry is more able to use and create value through research.

We will work towards a New Zealand where research plays a stronger role in informing public debate and helps to develop consensus on the important, long-term issues facing our nation.

THE SOCIETY'S STRATEGIC DIRECTION

THE SOCIETY'S BROAD ACTIVITIES

The Society focuses on excellence in the practice of science and improving the performance of the science system. We contribute to New Zealand's future through our efforts to promote public understanding of science and technology, to advance science and technology education and by providing expert advice to the Government and the community. We support the science and technology community through our promotion of excellence, support for development and professional needs and by our publication of journals presenting New Zealand research.

We believe there are significant issues affecting the future direction of research in New Zealand, including business investment in research, maintaining research capabilities, supporting long-term career development, infrastructure and funding.

To provide leadership for the science sector, the Society is setting up a National Science Panel. This group will be independent of the Society but will be supported by the expertise of our Fellows and members. We also see a clear need for more expert advice to underpin debates on issues affecting New Zealand's future. Hence we desire to increase our role as a provider of independent, evidence-based advice. We also act as a unique forum for debating and assessing the performance of our science system.

THE SOCIETY AND THE MINISTRY

We wish to develop a more strategic relationship with MoRST, to aid MoRST in delivering on their priorities, especially regarding communication of science and international connections.

While we are keen to work with MoRST and other Government bodies, our independence is explicitly recognised in our Act and enables us to credibly present expert-based advice and activities. However, the Act provides no means to fund these activities.

THE SOCIETY AS A PURCHASE AGENT

Last year's PricewaterhouseCooper's "Efficiency and Effectiveness" review[3] made clear the three ways that the Society, as a purchase agent, creates value:

- Through administering Funds for Government
- Through the research funded through the Society
- Through assessing outcomes and providing advice on effectiveness and direction

Our research contract management provides scrupulously fair evaluation procedures, continually improving allocation and decision processes, monitoring the outcome of research investment and proving feedback on the outcome of that investment to guide the future allocation and direction of funding.

The Society already participates in discussions around the direction of funds that the Society administers. However a better match could be found between our role as a purchase agent and MoRST's expectations for funds that we administer if that participation was enhanced.

THE MARSDEN FUND COUNCIL AND THE ROYAL SOCIETY

The Marsden Fund Council (MFC) has overall responsibility for the Marsden Fund, with the Royal Society administering the Fund on behalf of the Council.

The Marsden Fund Council defines the strategic direction and vision for the Marsden Fund, allocates funding, and provides governance and direction to the Royal Society on policy, process, priorities, and the annual business plan for the Fund. The Council outlines its proposed new initiatives, *Future Development of the Marsden Fund*, on pages 19-23 of this *Progress and Achievements Report*. It reports on the added value it creates with the Royal Society in *Output Class Two – Research Contract Management of the Marsden Fund*, and on the effectiveness of the Marsden Fund and its performance in *Output Class Three – Marsden Fund.* This section includes an essay prepared by the Council on the *Impact of the Marsden Fund on the Wellbeing of New Zealanders*.

The Marsden Fund Council sees several changes necessary for the Fund to provide the maximum benefit. Changes are recommended to the Fund procedures to emphasise the transparency of the process, to the treatment of overheads on post-doctoral researchers so that they are still supported, and to provide longer-term funding for researchers with a track record.

Above all, the most beneficial change that could be made to the Fund would be to increase its size, so that the Fund can support more of the highest quality research in New Zealand.

CHANGES IN NZ SCIENCE SYSTEM AND RSNZ ACTIVITIES

We are heartened by recent improvements to the science system. Moving to a more stable funding system and explicit support for human capability is recognition of the inherently long-term nature of developing productive researchers and the need to retain and attract the best international talent. The increased future-facing emphasis taken by MoRST should help to guide the science system in a more productive direction.

The recent increases in the Teacher Fellowships fund, administered by the Society, will allow the scheme to make a greater impact. The increases to our management fee for the Marsden Fund should allow us to maintain the value that we add through our management of the Fund.

[3] PricewaterhouseCoopers, "Review of the Royal Society of New Zealand's Component of the Research Contract Management Output Class", November 2005

PROPOSED NEW INITIATIVES

FUTURE DEVELOPMENT OF THE MARSDEN FUND

The Marsden Fund Council continues to seek ways to further develop the Fund to maximise its benefit to New Zealand and to the research community. The Council has identified key issues facing the Fund as:

- the quantity of research that is funded within the available monetary constraints
- the expectations of the research community given their continuing strong interest in the Fund;
- the extent to which mid and late career researchers are being supported; and
- the large number of proposals that are judged as internationally excellent and outstanding but can not be funded;

Priority needs to be given to either increasing the size of the Fund or altering the way in which research projects are funded to:

- develop intellectual potential in New Zealand (building human capacity),
- enhance New Zealand's access to global knowledge (international connectedness), and
- provide more seed funding for research that leads to economic, social and environmental benefits for New Zealand (building the knowledge base).

CHANGES TO THE FUNDS GUIDELINES

Despite the fact that the Fund's current 'Conflict of Interest' processes can be demonstrated to be fair, the Council recognises the need to be seen to be both fair and transparent by the public. In light of this, the Council decided in August 2006 prior to the announcement of the results of the 2006 funding round, that the guidelines be changed so that sitting panellists will no longer be able to put applications to their panel.

ABILITY TO FUND MORE HIGH QUALITY RESEARCH

There is substantial scope for increasing the Fund's delivery of its objectives by increasing the number of awards made. There is strong evidence that, if the size of the Fund was doubled that it would still be possible to select only the highest quality projects to fund (presented in Appendix 2). At this level, only proposals considered by international reviewers to be among the top 20 % worldwide would be being funded.

The Marsden Fund Council is conscious of the need to balance the prestige of receiving an award against expanding access to funding, but it is also conscious that the Marsden Fund sets the standard for excellence in the research community. So, their recommendation is an increase in the size of the Fund to at least $53 million per annum and to spread the financial impact of the expansion of the Fund over the next 3 years.

The benefit of an increase of this magnitude would be the increased quantity, and breadth, of the very highest quality research undertaken, and the consequent expansion of the contribution to the knowledge base in New Zealand. It would also have the effect of boosting the confidence of the research community, some of whom choose not to submit their research ideas because of the low success rates historically for applications to the Fund.

THE COST OF RESEARCH

The majority of the Marsden awards are currently made for research at universities. Under the present full cost funding regime for costing research at universities, Marsden funds pay for researcher time (usually time buy-out if the researcher is an academic), for institutional overheads and for the direct costs of the research (e.g. chemicals, travel). Over the past seven years, the annual value of awards increased from $23 to $34 million, but too much of this increase has gone to paying salaries and overheads.

A particular concern is the Fund's ability in the future to be able to continue supporting postdoctoral research. The cost attribution model used by universities requires that full overheads be added to the actual salary and direct project costs. This means that simply including a postdoctoral researcher on a project adds substantially to the cost of a proposal. Increasingly, postdoctoral researchers are being eliminated from proposals. This is unfortunate, as being able to support postdoctoral researchers is an important aspect of building intellectual capacity in New Zealand.

The Council is considering overcoming this by instituting a fellowship scheme for postdoctoral researchers that will, in a similar way to the New Zealand Postdoctoral Research Fellowships, provide for the salaries of the recipients and make a contribution towards their project costs. The Council notes that FRST's New Zealand Postdoctoral Research Fellowships and their counterparts from the HRC are only awarded in specific areas that are relevant to their research themes. As the Marsden Fund is untargeted, a scheme of this nature would allow New Zealand's best young researchers to be supported as they emerge from their Ph.D. studies, regardless of their field of specialisation. A scheme of this nature would broaden the Fund.

At present awards are given to Fast-Start applicants (who have to have a staff position at an institution and be within seven years of having obtained their Ph.D. after allowing for any non-research time such as parental leave) and to Standard applicants who can be at any stage of their career. There is a trend for young researchers to remain in post doctoral positions for much longer than in the past. So, by the time they receive a career position, they are often no longer eligible for a Fast-Start award. Introducing a Fellowship scheme would allow the eligibility criterion for Fast-Start awards to be moved to ten years from the time of receiving a Ph.D., and allow more effective segmentation of the awards into postdoctoral, early career and full awards.

BUILDING HUMAN CAPABILITY

Whether it is achieved by increasing the overall size of the Fund or by changing the way in which Marsden research is contracted, a change should improve opportunities for a wide spectrum of researchers. Because of the high level of support given in Marsden projects to the development of new skills and to supporting postdoctoral and postgraduate research, the increase will particularly benefit younger researchers[4].

In addition, Marsden Fast-Start awards are used to kick-start the careers of promising young researchers. The scheme has been now been running since 2001 and 118 individuals have been supported. The grant is sufficient to allow the researchers two years of funding for their own personal -research programme; they are deliberately not large enough to provide for the hiring of other research staff, as the intention is that the researcher carries out their research themselves.

Supporting young researchers this way helps them build practical research skills and enables them to choose to investigate their own questions. This initial support helps them build evidence of successful and novel research practice so that they can compete with the track records of more experienced researchers.

[4] Figures A2.2 and A2.3 in Appendix 2 shows the age distribution of Marsden recipients from past years.

The value of Fast-Start awards is also being increased from $70k per year to $85k per year (inclusive of GST) in 2007 so that a significant proportion of a recipient's time can be funded.

ENHANCING GLOBAL CONNECTEDNESS

An already strong feature of the Marsden Fund is the contribution it makes to global connectedness. Appendix 2 provides information on the very high level of international collaboration, including involvement of foreign researchers, joint publication of research and the travel and exchange opportunities for New Zealand researchers generated by Marsden funding.

RECOGNISING TRACK RECORD

New Zealand has a small number of researchers who are recognised as being at the top of their field world-wide. There are also some researchers who have had repeated success with their applications for Marsden funding. It is particularly noticeable that in a year when these researchers do apply, that the relevant panel is not able to fund as many proposals from researchers who are new to the Fund. The Council is investigating options for a scheme to provide longer term funding for one of these previously successful researchers where the choice is influenced by track record as much as their ability to articulate a new idea; however, the current level of the Fund means that such an initiative cannot be trialled without further damaging the Fund's success rate.

GRANT FUNDING FOR THE RSNZ

Our Act charges us with many activities; it does not mandate any funding for those activities. For example, we are mandated to "provide expert advice on important public issues to the Government and the community". We can call upon our Fellows, members and other national and international experts. These people represent a willing but underutilised resource that can be a source of rapid, balanced and impartial advice. Our non-aligned position allows us to act as an honest broker and gather together diverse organisations in a neutral forum.

We currently provide advice from national experts and committees to the public, journalists, Members of Parliament, and government bodies. Last year, the policy unit and committees produced ten pieces of advice to MoRST, MED, MinEdu, PCE, DoC and MedSafe. These included substantial contributions and original research. Committee workshops included "Managing drought risk in a changing climate" and a School Leaders' strategy symposium. This year, we have already produced a substantial report on energy to inform MED's Energy Strategy work and provided IRD's Business Tax Review project with a paper reviewing the R&D tax treatments of the thirty OECD countries.

The Society funds these activities from its own resources, supplemented by small contracts to administer specific advice from time to time. We believe that a substantial expansion of this role would provide a useful source of credible and independent expert advice to inform policy and public dialogue, in a role similar to that of other royal societies and national academies across the globe. This advice can assist in building consensus on new scientific issues and the response to coming challenges such as climate change, embryo research and human reproductive technologies, xenotransplantation nanotechnology and other emerging areas in biotechnology.

To develop our expert advice and strategic analysis capability and to further our relationship with Government we seek the support of 4 FTE (up from the current two), and ongoing support for panel meetings and discussions. This would expand the capability of the policy unit to provide a broader range of advice and allow the provision of more timely and more detailed advice and analysis. We envision this as a shared programme, with the Society supporting our two current FTE, and Government support allowing two more and panel costs.

COMMUNICATIONS

The Royal Society is the premier science communicator in New Zealand. Through our work we:

- promote a critical awareness of issues surrounding science;
- provide a knowledge base from which citizens can discuss issues and reach consensus where possible;
- encourage the younger generation to become scientifically literate and to use that literacy in their future; and
- promote a basic understanding of the way that science works and the kinds of questions it can address.

We carry out this work using not just our staff resources, but the abilities of Companions and Fellows, branches, and constituent organisations as well as our connections with the community, media and sponsors.

We wish to use our competence to deliver larger, higher-impact programmes along with MoRST's overall direction for science communication. The Society is able to use its excellent track record to bring in private sponsorship for activities, resulting in considerable leverage on Government investment. For example the International Institute of Modern Letters was able to bring in the matching sum from a private benefactor as a result of winning a Smash Palace grant for Are Angels OK?, an idea we initiated and developed. Our ability to maximise media coverage from such programmes is well known. The Royal Society is uniquely placed to promote science in the media and would like to extend its work in this area. To expand our media/promotions capacity, and to seed fund major programmes such as Year of Physics - the stimulus for Are Angels OK? - we are seeking to fund a middle level communications position and some operational expenses associated with these functions.

EDUCATION

Inspiration of our younger generation creates the researchers of tomorrow. The Society is proud of its track record in this area, providing many high impact activities and gaining more than half our operational funds from sources other than Government. However, this is not enough. The numbers of students taking an interest in science are being diluted by the numerous options now available, and they continue to fall from an already low number by international comparisons. New Zealand can not afford to allow interest in the sciences to drop at a time when economic transformation is occurring, requiring people skilled in science and technology. Society believes that more must be done in this area and requests support in growing and supporting the interest that young people have in science.

Our aims under our educational mandate are to excite and inspire young people in science and technology, to increase teacher enthusiasm, knowledge and skills, and to increase science and technology participation in the tertiary sector. Hence our activities provide authentic learning activities, interaction with practising researchers, resources for teaching and learning, and opportunities for recognition and reward. To this end, we carry out a necessarily wide-ranging set of activities for students of a range of ages, abilities and interests.

This year, evaluation of the Teacher Fellowships has shown that the scheme is working well and its enlargement should increase its impact. However, there are areas of under-representation with teachers from primary schools, low decile schools and some geographic areas being poorly

served by the scheme. We propose some adjustment of the scheme criteria and publicity to improve the reach of the scheme. More could be made of the dissemination of the learning developed by teachers within the scheme and we propose to increase activities in this area.

The CREST Awards have been very successful, yet the programme exists on a year-to-year basis, dependent upon whims of private funders. This instability compels staff to spend time looking for support for the programme, rather than helping the programme to make an impact. We wish to place CREST on a firm footing with longer-term support. We desire to support teams of young students to the international Science Olympiads, to improve the Young Achievers database by providing an interactive website, increasing the opportunities for young people (up to tertiary level) to participate in international science and technology events such as the Lindau Nobel meetings. We also wish to expand student work-experience scholarships introduced last year. This year's experience of the scholarships has shown that they are keenly sought after.

This range of additional activity would require an increase of staffing, phased to match strategic plans for this sector of activity.

INTERNATIONAL

The Society's international activities help connect our researchers with the mass of overseas research. Those connections often lead to significant leverage upon our small investments in this area. Hence the Society proposes that the Bilateral Research Activities Programme be expanded to enable more support for international collaboration.

OUTPUT CLASS 1 - RESEARCH CONTRACT MANAGEMENT (EXCEPT THE MARSDEN FUND)

"…the processes used by RSNZ … are viewed by stakeholders as being "gold standard"."[5]

ADMINISTRATION OF FUNDS AND SERVICES

Our output agreement with MoRST sets out our responsibilities for the funds and services that we manage for Government. These involve promoting the funds, facilitating the assessment procedure, negotiating contracts with awardees, disbursing funds and monitoring the progress and impacts of projects. Our output agreement reports show that our performance is as required, with a very high degree of compliance to the agreement.

The Society uses transparent and scrupulously fair procedures to assess applications to funds and to run allocation decisions. Our good reputation with the research community allows us to carry out this allocative process without losing the trust of that community. As over 92 % of Marsden applications are turned down, this ability is a vital part of our activity.

In allocation processes based on peer review, high quality decisions will only be possible if high quality people are involved. Our integration of a wide range of activities across the research spectrum creates strong and broad connections with the research community, both domestically and overseas. This allows us to know who to call upon to act as reviewers, assessment panel members, or to sit on editorial boards for journals. Our reputation leads those calls to be viewed favourably. The majority of our funds[6] do not provide honoraria for assessment panel members – we have to ask highly skilled and busy people to work for free. Hence our reputation for fair and transparent processes it vital to our performance in running these funds.

The staff involved in running these funds have a thorough understanding of the communities the funds support. In part, the Marsden Fund is run by able ex-researchers with experience of, and connections into, the NZ research sector; education funds are also run by ex-teachers with experience of, and connections into, the NZ teaching sector. In some cases, fund administrators and managers have been applicants to the funds and thus can view the application processes from both ends.

However, the Royal Society goes beyond merely administering the funds and services. The Society's actions actively create value through continually working to improve the processes and monitoring and evaluating the outcomes of investments.

BEYOND ADMINISTRATION

The PricewaterhouseCoopers review noted two more areas where the Society adds value above and beyond the simple administration of the funds. The research supported by the funds and managed by the Society as a purchase agent creates value for New Zealand. That value is discussed in the corresponding fund sections of this report.

Secondly, the Society evaluation and assessment of the fund processes and monitoring of outcomes informs the strategic advice we give to Government and the Marsden Fund Council.

---

[5] PricewaterhouseCoopers, op cit

[6] Teacher Fellowships, James Cook Fellowships, ISAT Linkages, International Conference Fund, and Talented Secondary Students Travel Awards

Evaluation capability within the Society is one that provides floating analytical, research, and technical support to other units as needed. Examples of this include: a review of the James Cook Fellowship reporting processes resulting in a recommendation that it move towards online reporting; collection and maintenance of the Royal Society indicator series to inform Council; a review of the Marsden Fund's site-visit process resulting in simplification of the interview structure; and, preparing reports for the Research Funding Unit to satisfy requests from the Ministry of Women's Affairs regarding gender equity in the Marsden Fund application process, and, MoRST regarding the NERF evaluation, and the Decade in Review report, amongst others. In addition, information has been provided to place the Marsden Fund within the international practice of funding in the humanities for the HERA (Humanities in the European Research Area) group.

The evaluation unit has also provided representation on behalf of the Society in drafting: the evaluation framework for Vision Matauranga; New Zealand's response to the OECD recommendation on access to research data collected though public funding sources; MoRST's revised performance measures for the Society; the MoH consultation on their public consultation process regarding stem cell research; and the Cancer Control Council's research stock-take report and their subsequent strategy document.

Evaluation of the Teacher Fellowship scheme revealed a low numbers of teachers applying from lower decile schools. This year sees the development of steps to reduce this disparity. Because the evaluation was carried out in-house, there was no delay between the finding and the rectifying actions. The tracking study further revealed that the fellowships improved the retention of teachers, allaying criticisms of the scheme.

Evaluation of the ISAT Linkage Fund Scheme showed the value that researchers gained from forming long-lasting overseas collaborations, in terms of productivity, establishing new skills and the ability to leverage additional funding. The evaluation also revealed that applicants saw the application procedure seen as difficult. The Society has redesigned and simplified the procedure in response.

Similarly, the information produced by the Marsden team guides the Marsden Fund Council recommendations and was at the basis of decisions to create the Fast-Start Awards.

Recent evaluations[7] have included:

- Better teaching by doing: a mixed-method evaluation of the NZ Science, Mathematics & Technology Teacher Fellowship programme (2006)
- Performance of the ISAT Linkage Fund Scheme: A survey of 2001 to 2003 recipients (2005)

PERFORMANCE MEASURES FOR RESEARCH CONTRACT MANAGEMENT

The output agreement provides several performance measures relating to the administration of the funds and services provided. These measures clearly show the Society's high standards for the allocation process. However, they do not directly inform MoRST about the improvements that the Society makes to the process, nor do they assist in comparing research contract management performance across funds or purchase agents.

The Society agrees with the MoRST position that a simple measure of fee as a percentage of fund size is a poor measure because of the range of fund sizes and activities involved. Better measures should be developed. One measure might be the costs per number of applications processed or

[7] Listed at http://www.rsnz.org/funding/evaluation/

awarded. This allows better comparison between funds of different sizes. The measure is still far from perfect, with costs often scaling in a step-wise fashion.

OUTPUT CLASS 2 - RESEARCH CONTRACT MANAGEMENT OF THE MARSDEN FUND

The Marsden Fund is governed by the Marsden Fund Council and is administered by Royal Society staff under a contract between the Royal Society and MoRST. A Memorandum of Understanding underpins the relationship between the Royal Society and the Marsden Fund Council. The success of the Marsden Fund is a testament to the success of this tripartite arrangement and, in this section, some of the qualities of the Fund are identified and related to roles of the Council and the Society.

The Marsden Fund, Te Pūtea Ranaghau a Marsden, stands first and foremost for excellence. This has been the consistent message from both the Marsden Fund Council ("Funding for research excellence") and the Royal Society of New Zealand ("Promoting excellence in science and technology"), and there has been no compromise on the Terms of Reference which require that the Fund be allocated on merit alone. As a result, the Marsden Fund sets a benchmark for other funds. For example, "As further evidence of high quality research, a third of NERF investigators are also recipients of awards from the Marsden Fund, a programme known for supporting world-class basic research."[8]

The Terms of Reference also specify a key objective as being to broaden and deepen the research skill-base in New Zealand. The Council has consistently supported outstanding early career researchers, not least by introducing the Fast-Start programme. For example, four out of five of Otago University's 2005 Early Career Awards for Distinction in Research were awarded to researchers with current Marsden grants, and five out of six in 2006. The inaugural winner of the University of Otago's Rowheath Trust Award and Carl Smith Medal in 2004 was a Marsden researcher, as was one of the two joint winners in 2005. All three recipients of Massey University's Early Career Researcher Award in 2005 were Marsden researchers. And Dr Fiona McDonald of Otago University, another Marsden recipient, received the New Zealand Association of Scientists 2005 Research Medal (for outstanding research by a young scientist). Dr McDonald is one of nine winners of this medal, eight of whom have been strongly supported by Marsden.

Marsden is uncomplicated, relatively unchanging, and this is widely appreciated by the research community. This constancy is due, in part, to the Funds consistent emphasis on excellence and the governance and administrative styles of the Marsden Fund Council and the Royal Society respectively. This factor, along with the engagement of the research community in the running of the Fund, has led to a high level of researcher confidence in the Fund.

The Marsden Fund's interaction with the research community occurs on a number of levels. The Fund deals officially with the research offices but a distinctive characteristic of the Fund is that it has a direct line to researchers. Marsden makes a point of visiting the individual researchers and research teams. This provides high quality evaluation information and great insight into the research. It also provides a frank means of exchange, which means that the Fund has a very clear picture of how its money is being spent and the impediments to greater research productivity. This has informed Council decisions. The strong lines of communication to the researchers and their institutions allow the Marsden Fund administration to be highly responsive to the researchers' needs.

A strong advantage of the current structure for running the Fund is the synergy between the activities of the Marsden Fund Council and those of the Royal Society. In particular, the close contact between Marsden and the research community allows the administrators of the Fund to

[8] "Outcome Evaluation of the New Economy Research Fund", prepared by Abt Associates for MoRST, September 2005

identify opportunities for publicity that are can be used directly by the Fund or can be used to contribute to other programmes within the Society. There have been several examples of this in the past year, with substantial Marsden contributions to two 2005 World Year of Physics activities, $E=mc^2$ and *Are Angels Okay?*, and to the *BIG Science Adventures* video competition for secondary school students.

Marsden also identifies and directly publicises outstanding research. Through the publication of its newsletter, *Marsden Fund Update*, in 2005/06 the Fund was able to publicise the research associated with more than 100 projects. In December 2005, a full colour, twenty four page tenth anniversary edition was released and 14,000 copies were circulated to media, the research community, government departments, public libraries, colleges, and individuals. In addition, the Fund makes press releases, particularly on the results of its annual funding round. In 2005/06, at least forty four newspaper and magazine articles appeared on Marsden Fund research. In addition, the Fund encourages its researchers to publicise their work and many researchers have appeared in the newspapers, on radio, and on television.

At an operational level, the support of the Royal Society in providing accommodation, information technology, publishing facilities, and publicity, means that the Marsden Fund can run an efficient secretariat, unburdened by the necessity to be self-sufficient in all the aspects required of a funding operation.

Overall, the organisational structure and skilled staff means that "the Marsden Fund operates a highly professional process that is well accepted by the scientific community in New Zealand and that would find widespread approval from the equivalent communities in other countries"[9]

[9] "Report of the evaluation of the impacts of the Marsden Fund", prepared by Web Research and Technopolis for MoRST, December 2004

OUTPUT CLASS 3 - MARSDEN FUND

OVERVIEW

PURPOSE AND OBJECTIVES

The Marsden Fund occupies a unique position in New Zealand's research environment. It sits at the discovery end of New Zealand's research spectrum and represents the Government's investment in the creation of new fundamental knowledge through scholarly research. The Fund covers the full spectrum from science, mathematics, and engineering to social sciences and the humanities.

The benefit to New Zealand of investing through the Marsden Fund is not only delivered through the portfolio of research funded, but also by the intense competition that applicants go through each year to receive funding and the high standard of excellence required for proposals to be successful. The Fund supports and encourages excellence in the advancement of knowledge, expands the knowledge base, and broadens and deepens the research skill base in New Zealand. It not only enriches the environment for research in New Zealand, but it delivers direct benefits through the new knowledge (leading to economic, social or environmental gains) or by providing seed-funding to enable new ideas to be tested and developed before other sources of funding support are sought.

The most significant challenge facing the Fund is maintaining and building on this contribution to New Zealand. Marsden awards are highly sought after, and because of changes in the way research is costed by institutions, the amount of actual research supported by the Fund has not matched the increased Government contribution to the Fund of recent years. Only 8 % of applications are funded and the amount being spent on direct research costs is constrained. To continue to be effective, the Fund either needs to be significantly increased in size, or changes need to be made to the way Marsden funds research.

GOVERNANCE

The Fund is operated under a Terms of Reference issued by the Minister of Research, Science and Technology who also appoints the governing body, the Marsden Fund Council. The Council has responsibility for setting the strategic direction of the Fund, allocating funds to projects and overseeing the progress of the research and researchers. They are supported in this by the Royal Society of New Zealand who organise the selection process, manage the disbursement of funds, monitor progress and evaluate the outcomes from the research, and provide secretariat services. A Memorandum of Understanding agreed between the Royal Society and the Marsden Fund Council describes the separation of the roles and performance expectations.

SCOPE AND SCALE

In 2005/06, the Marsden Fund operated as a separate Output Class of the RS&T system, with an investment budget of $33.878 million (5.5 % of Vote: RS&T)[10].During the year, 372 research contracts were operational, covering the humanities, social sciences, sciences, mathematics and engineering. $33.5 million (net of returned funds) was distributed to active contracts.

10 Figure in this report are exclusive of GST and care should be taken when making comparisons with previous years.

In simple dollar terms, the Fund has increased in size steadily since its inception 10 years ago. In 2005/06, the Fund was increased by $3.45 million to $33.88 million. It will remain unchanged in 2006/07 and no further increases have been signalled. More detail on the historical growth of the Fund and the support given to discipline areas in the past year is given in Appendix 1.

MAXIMISING THE FUND'S IMPACT

The Marsden Fund Council believes the Fund should increase by a further $19.42 million over the next 3 years to $53.3 million per annum. ($60 million including GST) This report makes that case based on the value the Fund delivers through its role in

- developing intellectual potential in New Zealand (building human capacity),
- enhancing New Zealand's access to global knowledge (international connectedness), and
- seed funding research that leads to economic, social and environmental benefits for New Zealand (building the knowledge base).

The positioning of the Fund to deliver these benefits were highlighted by an independent review of the Fund carried out in 2004 in which it was concluded inter alia that:

- The kinds of investments that the Marsden Fund makes can be expected to produce high, and positive social, cultural and economic returns;
- Marsden's returns are most likely to be generated indirectly, such as from human resource development, or initiating new areas of discovery;
- New Zealand spends a comparatively low proportion of its GDP on non-oriented research. Since such research plays both an economic and a cultural role, there is a case for increasing national expenditure on it;
- Marsden is funding a low proportion of proposals when compared with similar international funds and research councils. About 8 % of applications are successful, against an international benchmark of 20-30 %.

The Marsden Fund Council strongly endorses those conclusions. The Marsden Fund sets the standard in New Zealand for its portfolio of high quality research and for the rigour of the process used to select projects for funding. The Marsden Fund supports projects at the cutting edge of their discipline that explore new ideas, develop fundamental understanding, and enhance knowledge for future innovation. In doing so, Marsden funding contributes strongly to the development of a highly skilled research workforce and to connecting New Zealand's research to the rest of the world. Later sections of this report describe this in more detail.

MARSDEN FUND

TE PŪTEA RANGAHAU A MARSDEN

THE IMPACT OF THE MARSDEN FUND ON THE WELLBEING OF NEW ZEALANDERS

An Essay by Dr G Carnaby and the Marsden Fund Council

1. INTRODUCTION

The Marsden Fund sits at the discovery end of New Zealand's research spectrum, allowing our best researchers to explore their own ideas. It represents a government investment in the creation of new fundamental knowledge through scholarly research. It covers the full spectrum from science, mathematics, and engineering to social sciences and the humanities. The impact of the Marsden Fund spans a wide range of Government policy objectives; the intellectual stretch which its excellence focus fosters, is multiplied and leveraged by much larger expenditures by the State and the private sector.

2. THE DEVELOPMENT OF THE INTELLECTUAL POTENTIAL OF NEW ZEALANDERS

The Marsden Fund has a major effect on the development of the cleverest individuals who collectively will be our most valuable resource in New Zealand in the future. The intellectual leaders from our university and knowledge-based institutions compete vigorously to gain funding from the Marsden Fund. Success provides an opportunity for the most creative people in the country to free up time to engage in research of their own choosing. Success in their research brings mana, peer acclaim, and a position of leadership to those who achieve it. The Marsden Fund sets the standard for excellence in intellectual life in New Zealand.

3. ACHIEVEMENT OF GLOBAL CONNECTEDNESS

Science is a global phenomenon built on an enormous tradition which is one of the foundations of Western culture and economic might. All cultures have knowledge systems of varying degrees of similarity, and there has been a post-colonial merging of these knowledge systems so that science is, today, a universal language to which most of mankind is connected.

It is a fact of life that over ninety-nine percent of science discoveries happen outside of New Zealand. This discovery process is generally characterised by open exchange of ideas. But to participate fully in this exchange, New Zealand researchers need not only to listen and read but must also be able to make contributions which will be valued internationally. Only by the participation of our best can the New Zealand science and technology sector hope to remain fully engaged and expert in the full range of modern science.

The Marsden Fund supports the international participation of our best scientists and scholars in the humanities and social sciences; who share our own human experience with people everywhere and participate in a global exchange of ideas and critique of knowledge.

The process of selecting the best research and best researchers is substantially guided by peers, who are selected as reviewers solely because they are the world experts in a particular field of knowledge

4. IMPACT ON THE EDUCATION OF NEW ZEALANDERS

More than half of the successful applicants to the Marsden Fund are academics employed in our principal universities. The competition for funding is so intense that it is commonplace for scientists or scholars who hold a personal chair, or who have already achieved great eminence, to fail to secure funding in this bidding process. Although this situation encourages them to try harder, the current success rates are so low that the process is wasteful of precious talent and energy. Really brilliant ideas must be turned away for lack of funding, even though they are of truly top international standard.

It is a well established fact that the world's best universities are populated by academics whose teaching and mentoring of students is, in itself, informed by active research at the knowledge frontier.

Vote Education and the funding of the universities dwarfs the independent investment in the Marsden Fund. The PBRF system, the CRI Capability Fund and the establishment of the CoREs has highlighted and strengthened the academic excellence of our public research Institutions, but the Marsden Fund sets an even more demanding standard which fuels the aspiration for research excellence.

The focus of the Marsden Fund is not primarily on the provision of student fellowships, but most supported projects do involve the development and training of research students and post doctoral Fellows as part of the overall project, and it encourages emerging researchers early in their careers through its Fast Start category of project funding.

The inspirational projects sponsored by the Marsden Fund have been centre stage in efforts by The Royal Society and others to encourage school students to consider a potential career in research.

5. THE IMPACT ON ECONOMIC GROWTH WITHIN NEW ZEALAND

All areas of research funded by Marsden have the potential to create new sources of wealth creation. The case for the humanities or social sciences is no less strong than the case for discovery science. In the case of the humanities, research outcomes can be applied, for example, using information technology to establish new creative industries, or tourism ventures. The humanities may contribute to film or television documentary or books, and are integral to producing knowledge about our own distinctive culture.

The case for investment in science discovery research within New Zealand must be considered within the context of the scale and local specialisation of our economy. International science leaders (e.g. Sir Paul Nurse) stress the need for prior basic research to enable applied research to reach new heights.

It is an open and shut case that the United States should invest strongly in discovery science. Their economy is likely to be the place where this can most easily be converted into new globally pervasive technology. They will gain by default, even though the process of converting science discovery to commercial technology is rarely linear.

New Zealand is unique in that it enjoys a first world standard of living whilst still exporting mainly commodities. For our economy to prosper in this century we have the challenge of adding new high value sectors, whilst ensuring the constant renewal of the ones we already have. To believe that we will be able to do this without the support of a world class research capability would be extremely naive.

5.1 BY THE CREATION OF NEW INDUSTRIES.

It is inevitable that some, but not all, of the discovery science done in New Zealand will lead directly to new industrial sectors not necessarily related to our current specialities. A past example arising directly from Marsden research is the new therapeutic pharmaceutical portfolio based on Colin Green's research at the University of Auckland. New Zealand will benefit from substantial royalty revenues earned from the commercialisation of these products through NZ owned US based Companies such as CoDa Therapeutics, Inc. Another example is the atmospheric wind modelling work of Andy Sturman's group at the University of Canterbury. This is now the platform being used by Connell-Wagner to advise on the generation of power from wind in our emerging wind energy sector. The low temperature conductivity research of Tallon, Buckley and others at IRL has led to the spinning out of HTS110 Ltd. Any one of these developments has the potential to return to NZ the entire sunk cost of the whole Marsden Fund expenditure of the last 10 years. Collectively, just these three projects will eclipse that value (~$300M). And there are now more than 500 other projects completed, many of which are already fuelling new separate impacts.

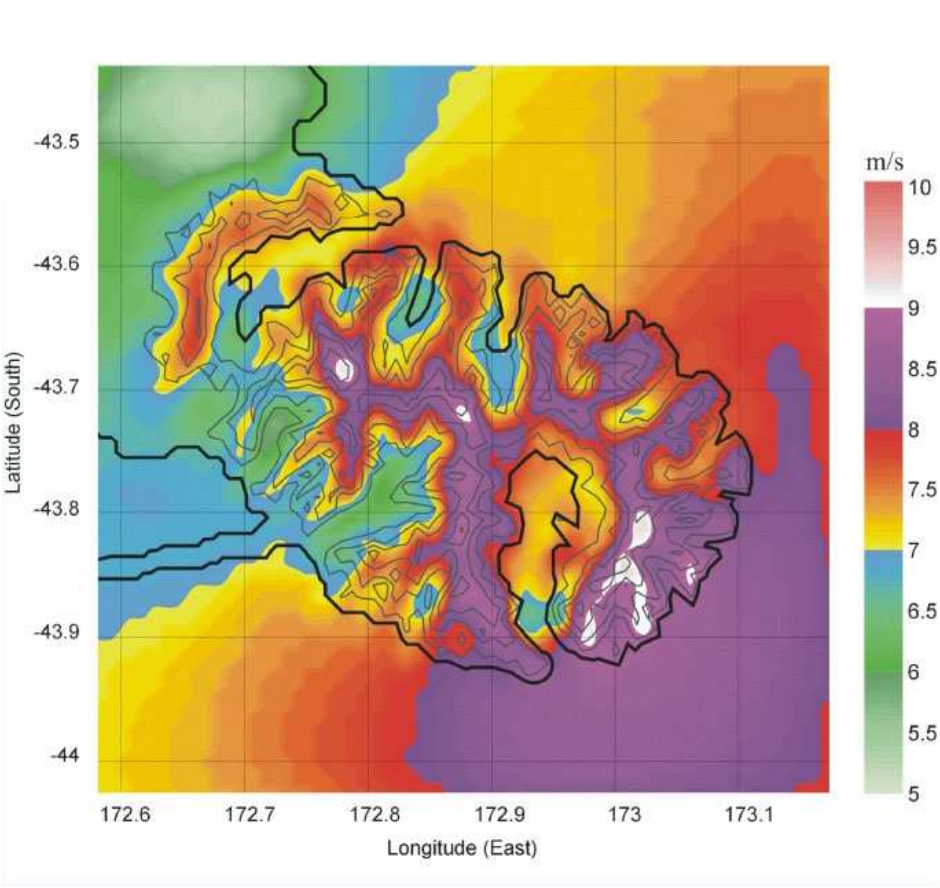


Figure 1. Map of the mean wind speed over Banks Peninsula in 2002 (50 m above ground at a resolution of 800 m), from the collaboration between Canterbury University and Connell Wagner.

5.2. THROUGH TECHNOLOGICAL RENEWAL OF ESTABLISHED SECTORS.

Our currently well established industries need to reinvent themselves every few years in order to retain their global competitiveness. It is not the role of the Marsden Fund to support applied research of this nature. Much greater resources than are available to Marsden are (and should be) applied to developing these key drivers of our largest industrial sectors. This is the role mainly of mission orientated institutes with strong industry networks and private sector funding.

It is not the intent of this note to argue that government support for discovery research should be increased at the expense of government leverage for mission oriented applied research. Typically the latter requires roughly 50% State leverage to be sustainable, as the risks for companies and industries are too high if they are faced with 100% of the cost. And without a large critical mass of applied research, the primary need for Marsden type research will be less, and our large drivers of proven wealth generation capacity will wither away.

Instead it is argued that the applied research effort in New Zealand aimed at increasing our competitive advantage (via IP) in our established areas of global comparative advantage (e.g. climate & land) will be far more effective if it has local access to advanced science knowledge.

It is the culture of applied research that the "need" dictates what aspect of science will be required to solve the problem (not the other way round). We don't know what science expertise will be needed over the next ten years, but we do know that the New Zealand applied research effort will need to access a broad range of sophisticated science expertise from advanced mathematics and physics to proteomics, all areas supported and enhanced by ongoing Marsden investment.

5.3 THROUGH THE TRANSFER OF SCIENCE KNOWLEDGE TO INDUSTRY IN THE HEADS OF GRADUATES

The technological knowledge advantage of our competitive industries is essentially held in the heads of the professionally trained technical staff who run them. Renewal of this human resource and the human resource in the applied institutes, with new graduates with contemporary global science knowledge is essential. It is here that the intellectual stretch, standards of scientific excellence, and global connectedness apply the greatest leverage on the entire education, science and technology capability of New Zealand.

If the activities supported by the Marsden Fund have sufficient leverage to lift our industrial and service industry competitiveness by just 1% over the long term, this will represent a gain of approximately $NZ1.2B per annum for an outlay of $NZ0.04B per annum, a Benefit to Cost Ratio of 300 : 1.

6. THE IMPACT ON POLITICAL, SOCIAL AND CULTURAL FUNCTIONALITY

Quite apart from leveraging the productive efficiency of the economy, Marsden research has the potential to have a more immediate and direct impact via social benefits.

New Zealanders are currently grappling with issues of national identity, biculturalism, multiculturalism, the implications for both Maori and non-Maori of Article 2 of the Treaty, historical perspective, changes in family structure, behavioural patterns and the character and cohesiveness of our community. Despite our small size and open egalitarian way of life, New Zealand has one of the highest rates of child abuse in the Western world.

Through its research in the social sciences, Marsden is supporting our leading thinkers in their efforts to propose new research based ideas and perspectives on the host of issues and

opportunities that confront of our society. New paradigms may help us all to move forward with a stronger national consensus and identity. In this area in particular, many wonderful ideas which might unlock hidden potential or produce new knowledge about the distinctiveness of Maori, Pacific, and other groups, just cannot be funded with the resource available.

The human cost of not addressing these major social and cultural issues and not developing new paradigms is likely to be profound. It is difficult to do a Benefit/Cost analysis on the effect that reducing social dysfunction might achieve, as it is hard to price human misery. Equally the sheer pleasure that new intellectual insights into our society, history and culture provide are perhaps one luxury we can afford.

7. THE IMPACT ON OUR ENVIRONMENT

New Zealand has unique ecosystems, flora and fauna, and occupies a unique geographical position. By studying our own environment, we can contribute to knowledge of the universe, The Earth and to our own local surroundings. The economic value of a saddleback or tuatara is also hard to calculate, but the cultural and ecological value is immense. The Marsden Fund again plays a unique role in ensuring that our very best researchers in these areas can free themselves up to focus on these unique opportunities for research which will not otherwise be carried out. Maintaining and growing our economic drivers without destroying the beauty and cleanliness which makes New Zealand a precious place to live, will ultimately need to harness knowledge of the type which Marsden helps to create.

Research supported by Marsden is also helping to ensure that our population remains unscathed by natural events and disasters ranging from earthquakes and volcanoes, through tsunamis to global climate change.

8. SUMMARY & CONCLUSION

The Marsden Fund is a small research fund by national or international standards. At 7–8 % it has a proposal success rate well below the 20–40 % level found to be optimal for similar Funds in other developed economies. At such a low success rate, the transaction cost of a necessarily rigorous peer review process of selection is wastefully high and extremely de-motivational to our best researchers. Doubling the size of the Fund would greatly reduce the transaction cost as a percentage, would increase the outputs proportionately, and result in very little reduction in research quality.

The leverage of the Fund on the entire effectiveness of the enterprise, collective effort, and well being of New Zealanders is already enormous, and could be so much greater. The Marsden Fund provides stretch and aspiration to greater excellence that feeds right through the systems which develop our intellectual capital as a nation. The brilliant outputs of the researchers it supports are transformational in every respect and of profound consequence for our economic, social, cultural, and environmental wellbeing.

HIGHLIGHTS

BEGINNING A NEW DECADE OF DISCOVERY

Across the last decade the Marsden Fund has become synonymous with excellence – in research, in governance, in adding value. Now, looking beyond the first ten years of the Marsden Fund, it is appropriate to consider the ways in which current or recent grant-holders have used their Marsden-funded expertise to contribute to the economic, cultural, social and environmental fabric of New Zealand.

Marsden supports **outstanding early career researchers** as evidenced by the Fast-Start awards. The scheme enables emerging researchers to build their careers – and often catalyses a far wider impact. For example, Dr Conrad Pilditch from the University of Waikato has recently completed a Fast-Start grant to determine the extent to which the activities of sediment-dwelling organisms regulate estuarine sediment transport. Dr Pilditch says: "The project played a critical role in my inclusion in the NIWA-led Coasts and Oceans OBI which was funded late last year by FRST. The techniques developed during this project will play an essential role in the subcontract I was awarded…"

Marsden sustains essential basic **research capability** that cannot necessarily obtain funding from other sources. In referring to the Geological Time section of the of Natural Resources group of GNS, which has produced world-leading research on biodiversity and extinctions, the General Manager Research, Robin Falconer has said "it is impossible to overstate the importance of Marsden in keeping this group going."

Many Marsden projects contribute to the **economic** life of New Zealand by increasing the understanding of fundamental factors that affect agriculture and food production. A group of researchers from AgResearch are investigating chemicals called lolitrems that cause "ryegrass staggers" in animals grazing on ryegrass pasture. These chemicals are neurotoxins produced by a fungus that grows within the leaves of the ryegrass. The team has determined that a specific lolitrem inhibits a vital ion channel necessary for the maintenance of blood pressure and brain activity, and it is this inhibition that causes the characteristic tremors. It has been 70 years since ryegrass staggers was first reported, but only now has the mechanism of action of the neurotoxins been discovered. Continuing the ryegrass theme, a team of researchers at Massey University is investigating the mechanisms that maintain a successful symbiotic relationship between ryegrass and the fungus that produces the neurotoxins. They have found that if a single fungal gene involved in free radical production is inactivated, the symbiotic relationship between the grass and fungus breaks down, leading to uncontrolled growth of the fungus and eventual death of the grass. This implicates a role for free radical production by the fungus to maintain the symbiotic relationship, and is a new role for free radicals in biology. This work was recently published in a high-impact plant research journal, and clearly has the potential to positively benefit the New Zealand national herd.

Marsden sets a **benchmark in excellent research**, funding key contributions across the science spectrum. In biomolecular science, a team of researchers from the University of Auckland are looking at dopamine-containing neurons located in a specific area of the brain. When these neurons degenerate, Parkinson's disease results; however, the mechanism by which they are damaged is unclear. The team has found some evidence that damage of the neurons, and manifestation of Parkinson's disease, is caused by activation of a novel group of cell membrane proteins known as TRP channels. This activation may lead to toxic calcium overload and hence cell death. They have also found that these channels may play a role in neuronal damage that occurs following a stroke.

A team at the University of Otago have been researching the responses of nerve cells to chemicals called growth factors, and whether the response to the cell depends on which part(s) of the cell are exposed to the factor. Serendipitously, they discovered a new neuronal survival factor that was previously believed to be unique to the reproductive system; this has resulted in a high-profile journal publication and much media publicity. The researchers are continuing their research into this factor and have found that its developmental action may lead to subtle but wide-spread differences in the brains of males and females.

Marsden Fund grants facilitate **strong collaborations** across New Zealand and between disciplines. Researchers from GNS Science, Massey University, Lincoln University and the University of Otago have been conducting a multi-disciplinary research project on the geology, flora and fauna of the Chatham Islands. They have found exciting molecular and geological evidence that the Chatham Islands have been emergent as land for less than 4 million years, and recent colonisation of flora and fauna from NZ. These findings are important, because they alter the long-standing view that the Chatham's flora and fauna is ancient, and they reveal how rapidly speciation of flora and fauna can occur.

A better understanding of the fragility of New Zealand ecology is an important aspect of the Marsden Fund portfolio. Dr Rachel Fewster was awarded a Fast-Start Marsden grant to use a combination of DNA sequencing and statistical methods to investigate how rats reinvade islands and which islands are most vulnerable. She has examined the population genetics of Norwegian and ship rats from seven different islands around New Zealand. During the course of this research, Dr Fewster created user-friendly software suitable for conservation managers to visualise the genetic structure of populations. This could be important for DoC when deciding whether it is financially worthwhile to clear islands of rats.

With a similar theme of rat invasion of islands, a team of researchers from Landcare Research, led by Dr David Wardle, has investigated how alien organisms (in this case Pacific and European rats) affect ecosystem functioning through their interactions with native organisms (native seabirds). The team selected islands in the Hauraki Gulf with three different properties, i.e. rat free, Pacific rat (minor predator) only, and European rat (major predator) only, and comparing ecosystem functioning in each of these groups. They found that rat invasion acts as a major ecosystem driver and has wide-ranging effects both above and below-ground. This work has clear implications for conservation and understanding our past ecology.

The social sciences dimension of Marsden means that many projects have fed directly or indirectly into **policy-making**: informing systems and practices, and influencing decision-makers. Dr Christine Stephens, a Fast-Start researcher from Massey University has recently completed a project investigating "social connectedness" and contrasting "sense of community" between diverse urban and rural areas. She found that people in deprived communities have closer emotional links with the immediate community and fewer broader connections with social organisations and institutions; and rural communities have important structural and supportive connections that are threatened by the centralisation of services. This research has stakeholder support from Housing New Zealand and community groups, such as Plunket.

Many Marsden projects consider the context of current sociological issues. A team of researchers from the University of Auckland is investigating the interaction between the Māori and Chinese communities from the first encounters until the present day. Relationships were found to be close and cordial during the earlier part of the 20th century, but this had evolved over time to one of mutual wariness. The team also uncovered clear differences between the attitudes of rural and urban Māori, and between local born and new immigrant Chinese. However, a major finding was that both rural and city communities of Māori appeared to be more anti-immigration than Pakeha. This work could have implications for race relations, for integration of new immigrants, and for the formation of New Zealand national identity.

Marsden is about improving our **understanding** of things about which most of us have wondered. For example, how is it that flowers are so intricately coloured? A team of researchers at Crop and Food Research have been studying the control of pattern formation in snapdragon flowers. This has contributed to research that has recently featured on a cover of a high-impact plant research journal. They identified three particular genes control the intensity and pattern of pigmentation in flowers by influencing the amount of pigment that is made by the petal cells. These genes influence pigment expression in different ways to each other, and variations in the activities of these genes cause the striking differences in patterns and colours found in different species of snapdragon. And how did those creatures in the rock pools get there in the first place? A team of researchers from the University of Otago has investigated the dispersal patterns of one of the world's most widespread sea stars, *Patiriella exigua*, which is distributed widely throughout the Southern Hemisphere, despite being unable to move freely in the water. Using DNA sequencing, the researchers have found evidence that the species originated in Africa, and dispersed eastwards across the Indian ocean during the last ice age. They believe that this pattern indicates that dispersal probably occurred by rafting on wood or seaweed, facilitated by a current that flows from west to east in the Southern Ocean. This is one of the first studies to provide evidence of long-distance rafting as a means of dispersal, and is of broad interest to marine biologists as it indicates that rafting has an important role in evolution.

Marsden is making a growing **contribution to the cultural life** of New Zealand, and the library of books written with support from the Marsden Fund is expanding. For example, Professor Terry Sturm at the University of Auckland is researching the poetry and writings of Allen Curnow, one of New Zealand's most eminent writers. This year has seen the publication of Professor Sturm's edited book of Curnow's topical verse, which was written under the pen-name "Whim Wham". The book, "Whim Wham's New Zealand: The Best of Whim Wham 1937-1988" was launched by the Prime Minister and features Whim Wham's insights into a wide variety of social and political events, spanning a 50-year period.

PROGRESS AND ACHIEVEMENTS EVALUATION

SEEDING NEW ZEALAND'S KNOWLEDGE BASE

The Fund's contribution to New Zealand's knowledge base can be assessed by its focus on research quality, and the productivity of Marsden-funded research and researchers.

Observations made as part of the recent evaluation of the NERF programme, highlight the esteem with which the Marsden Fund is held in New Zealand, i.e., "The view that Marsden is a top-performing fund, in terms of science quality, was echoed during the site visits.", and the "[I]t is commonly accepted that Marsden funds the best scientists in the country…"[11].

QUALITY

The quality of Marsden contracts is maintained, in part, by the peer review process used to help select proposals for funding. The Fund aims to have each proposal refereed by at least 3 specialists, almost all of whom are from overseas. This ensures that only proposals meeting high international standards are funded and guards against the conflicts of interest that are inevitable in a small isolated research community.

[11] Abt Associates (2005) "Outcome Evaluation of the New Economy Research Fund" pp21. Available http://www.morst.govt.nz/Documents/publications/evaluations/NERF-Evaluation-Report.pdf

In the 2005/6 round, 94 % of the referees used were international, from a total of 26 countries. Approximately, three fifths of referees held Professorial positions, and another 7 % were Associate Professors. As a consequence, applicants, Government, and the public, can be confident that the chosen research is world class. In fact, in the 2005/6 round, ~55 % of standard proposals, and ~45 % of Fast-Start proposals, reaching the second stage were judged as being in the top 10 % of proposals that their referees had reviewed for all, almost exclusively international, funding agencies (see Appendix 2). Unfortunately, due to budget constraints only 38 % of these "Excellent"–"Outstanding" projects could be funded.

Contracts that have reported during 2005/6 have resulted in numerous publications in prestigious journals, including articles in Science, Nature, Cell, and the Proceedings of the National Academy of Sciences.

PRODUCTIVITY

Bibliometric analysis has shown that articles arising from Marsden projects are typically cited 1.7 times more often than the average for NZ-authored articles[12]. Publication figures for 2005 are still being compiled as, and when, the relevant contracts finish; however, the indications are that the trend of increasing numbers of publications is being maintained. It should be noted that publications continue to be attributed to the Marsden Fund for years after the contracts finish.

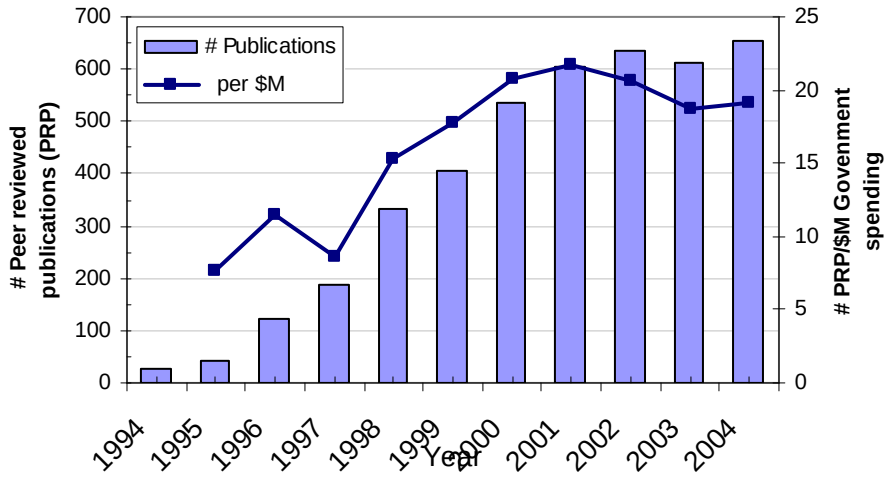


Figure 2. Number of publications per year and per $million funded by Marsden. The increase represents both the increase in the size of the fund and the many-year delay between funding of research and its publication.

In comparison with other New Zealand schemes, the Marsden Fund produces a high number of articles per dollar spent. From 2000–2004, the Marsden Fund has consistently produced between 18–20 peer-reviewed articles and books per $million awarded each year. For comparison, NERF and ENV funding produces 8 peer-reviewed articles per $million, and RFI funding produces 6 articles per $million and the NZ average was 6 articles per $million of GovERD and HERD[13] in 2000[14]. By this measure, Marsden has at least twice the productivity of other funding schemes.

[12] Knox, A.L. (2004) "The Impact of Marsden-funded Research: a bibliometric assessment of Marsden-funded publications, 1997-2001". Available http://www.rsnz.org/funding/evaluation/impact.php
[13] GovERD – NZ Government expenditure on R&D; HERD – Higher education expenditure on R&D
[14] FRST "Outcome Indicators 2003–04" http://www.frst.govt.nz/evaluation/downloads/outcome/2004-09-23_Outcome_Indicators_2003-04.doc

TANGIBLE BENEFITS FROM THE MARSDEN FUND

While the Marsden Fund has been widely cast as a basic research fund, as in Figure 3, the Fund is not confined exclusively to this part of the innovation spectrum. The Fund has supported, and will continue to support projects undertaking "applied basic" research, and even "experimental development" when the novelty and excellence criteria are satisfied. It must be noted that "experimental development" cannot be supported by the NERF programme.

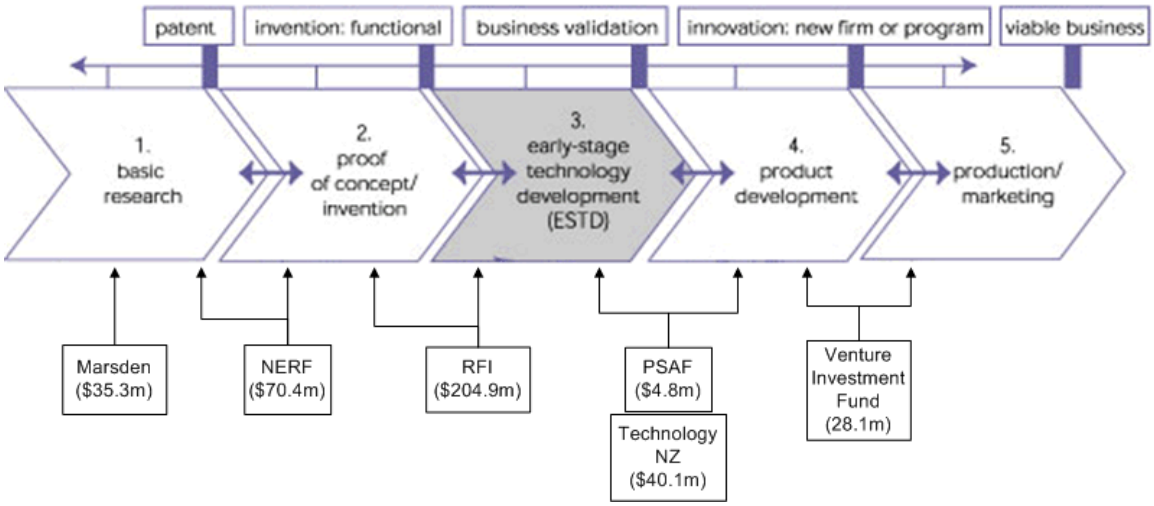


Figure 3. New Zealand Funds on the Innovation Spectrum[15]

Possibly as a consequence of the broad reach of the Fund, tangible benefits of Marsden-supported research can be demonstrated even though the Fund is only eleven years old and a plausible estimate for the transition from concept to market/practice is from 10–30 years[16]. Examples cited elsewhere in this report show that several commercial initiatives have emerged within 10 years of the commencement of funding. In support for the untargeted nature of the Fund, many of these outcomes were not, and could not have been, anticipated at the research's inception, e.g.:

- Following a serendipitous and, at the time, counter-intuitive finding while investing the role of inter-cellular communication in the progression of damage following injury in the heart and brain, Professor Colin Green and his former post-doc, Dr David Breker, have patented an approach that appears to promote healing and minimise scar-formation, in a wide variety of settings. This IP is being commercialised by an off-shoot of CoDa Therapeutics (NZ) Ltd, which has recently acquired USD$10M in venture capital, with the expectation of gaining another USD$10M by year's end. This financing will be sufficient to carry their lead-compound, Nexagon™, though to stage III trials in the US. Of note, this research, in turn has its origins in Professor Green's studies into embryonic development, which were also Marsden-supported.

NERF – New Economy Research Fund; ENV – Environment Output Class; RFI – Research for Industry

[15] Abt Associates, op cit

[16] Adams, J.D. 1990. "Fundamental Stocks of Knowledge and Productivity Growth." Journal of Political Economy 98(4): 673–702.
Hall, J., Scobie, G. M., 2006, "The Role of R&D in Productivity Growth: The Case of Agriculture in New Zealand: 1927 to 2001", NZ Treasury Working Paper

- A 1996 Marsden project on the origin of the Mackenzie Basin winds has been the genesis for a major commercial agreement between the University of Canterbury and the consulting engineering company, Connell Wagner. The agreement is for the use of the University of Canterbury's advanced three-dimensional wind modelling system, EPS, which will significantly reduce the time and cost of assessing wind resources. It has many applications, from prospecting for the best wind farm sites to short-term operational forecasting of wind farm output to help manage the national electricity grid.
- Associate Professor Alison Jones's research on the effects on teachers of current attitudes to touching children has led to a major overhaul of the NZEI's guidelines on contact between teachers and children. The guidelines are designed to assist the NZEI's 45,000 members in making schools and early childhood education centres positive and caring learning environments for their 860,000 students. The guidelines are a move away from more cautious policies that reflected previous, higher levels of anxiety in the community about physical contact between adults and young people.
- In the environmental area, Marsden funding has been supporting Dr Stephen Wing in his investigations of the marine ecosystem of Fiordland, particularly food webs and the dispersal of marine organisms. This work directly informed a management strategy for the Fiordland area, which has become enshrined in law as the Fiordland (te Moana o Atawhenua) Marine Management Act 2005.
- Syft Technologies Ltd makes sensitive mass spectrometers which have numerous applications including medical diagnostics, environmental monitoring, biosecurity, explosives detection, and petroleum exploration. This world first commercialisation of Selected Ion Flow Tube Mass Spectrometry (SIFT-MS) has arisen from sustained Marsden funding, since 1995. The technology was originally developed to investigate the chemistry that occurs within interstellar clouds, the enormous clouds of gas that exist between the stars. Syft now employs 27 staff and has established overseas distribution partners to assist with building a strong path to international markets. The company is now building market awareness through successful trade shows and European customer trials and demonstrations.

Figure 4. Syft's Voice100 instrument with Sales Engineer, Scott Noakes.

Also of note, Marsden can lay claim to feeding into a third of the spin-off companies detailed in the recent evaluation[17] of the NERF programme: i.e., from IRL (HTS-110), the University of Auckland (Proacta and Neuventis), the University of Canterbury (Nano Cluster Devices Ltd.), and the University of Otago (Pacific Edge Biotechnology Ltd) . The Fund has also provided support to Professor Ian McLennan for the work leading to the development of several patents by the University of Otago's commercialisation company, Otago Innovation Ltd (OIL).

"This is exciting technology with potential to bring huge clinical benefits."
OIL commercialisation manager Hamish Findlay

BUILDING HUMAN CAPACITY

The Marsden Fund has played a significant role in the New Zealand research environment. The Fast-Start award scheme has enabled emerging researchers to build their careers. The Fund provides support for many postdoctoral researchers and provides substantial opportunities for postgraduate research training (see Appendix 2).

[17] Abt Associates, op cit

PEOPLE SUPPORTED BY MARSDEN

Prizes and awards bestowed on Marsden researchers in 2005/6 include appointment to the NZ Order of Merit; election to the Fellowship of the Royal Society of New Zealand; Rutherford, Pickering, and Marsden Medals amongst others (see Appendix 2).

The Marsden Fund provides strong support for new and emerging researchers, as demonstrated by the large percentage of projects featuring Principal Investigators (PIs), and Associate Investigators (AIs), early in their research careers, as well postdoctoral fellows and postgraduate students. The 2005/6 funding round saw a continuation in the trend to younger PIs, with 48 % of contracted PIs being within 10 years of gaining their highest degree (in most cases a Ph.D.), compared with 27 % in 2000/1 and an estimated 17 % in the NZ research community.

The percentage of PIs who are women has grown steadily from the Fund's inception, when it was 6 %, to the current 28 %. This level of involvement of women researchers is an accurate reflection of the proportion of applications received from this group. Appendix 2 – "Building human capacity" has further information.

ACCESS TO INTERNATIONAL RESEARCH EXPENDITURE

INTERNATIONAL COLLABORATION

The Marsden Fund is associated with a high, and growing, level of international collaboration. Marsden research is of global significance and, as a consequence, attracts and supports overseas collaboration.

In the 2005/6 round almost half of contracts involved international collaboration at their inception (46 %), the highest to date portion so far. In addition to the contracts with international principal and associate investigators, many more develop international links during the course of the project due to the significance of the research and the opportunities Marsden offers to present the work internationally (see Appendix 2). As a consequence, the vast majority of projects have developed international collaborations by their completion (80 % for projects that finished in 2005/6).

> *"The Marsden led to a collaborations with [Australian researchers], who are now AIs on my new Marsden grant"*

Marsden can be seen as buying a ticket of membership into the international science system. The high proportion of Marsden contracts involving international researchers as collaborators, AIs, and in some cases, PI's, adds significant resources to New Zealand's research effort (see Appendix2). It must be noted that this is at little, or no cost, to Government, as the Fund does not pay salary to researchers that are based outside New Zealand.

> *"Like many of my colleagues I am impressed by the quality of the Marsden applicants and the work they produce, so am very happy to read applications that you get that stem from my area of familiarity"*
>
> comment volunteered by an Australian referee to the 2005/06 round.

LOST OPPORTUNITIES

Following the completion of their projects, Marsden investigators are asked whether they believe their project would have occurred without the Fund's support: from 2003–2006, 79 % of PIs agreed that Marsden "enabled research that would not have been possible otherwise", while the

remaining 21 % were of the opinion that their contract had "sped up" their research. For this latter group, the estimated time gained was in the range of years to decades and often they believed that in the absence of Marsden funding the research advantage would have been lost to groups outside New Zealand. Of note, no PI to date has been of the opinion that their work would have gone smoothly ahead without the Marsden award, and in some cases, quite the opposite.

The evidence is that the Marsden Fund is receiving what must be among the best research in New Zealand, and the world (see Appendix 2). Significant effort is expended through the funding process by both applicants, and the research community involved in the selection process. Unfortunately, although the Fund's processes are able to show that, at the very least, half of the proposals reaching the second stage are excellent, world-class, research programmes, the Fund is only able to offer support to ~60 % of them. This gap between what that Fund recognises as being eminently fundable, and what it can actually fund, is a growing source of frustration for the Marsden Fund's Council and panels, and in the research community.

> *"The Marsden Fund is a crucial feature of the research environment. Having been involved in successful applications to both FoRST and Marsden, and noting that they have different objectives, my opinion is that is would be optimal to reduce FoRST funding and increase Marsden Funding (if both could not be increased). Many excellent projects submitted to the Marsden Fund continue to miss out on funding."*
> *"[A]ny science funding system with the very low success rate that Marsden currently has, should be of serious concern – it means that a large amount of NZ's science capability is simply being wasted by chasing the small amount of money available. I believe it is also misleading for Marsden to cite project funding success rates, when many of those "funded" projects have also been asked to accept significantly reduced funding levels to run their successful project bids."*
>
> Anonymous Marsden Investigator

As reported in the Society's 2004/05 PAR, significant increases to the Fund would be required for it to be able to award all proposals that are recognised as the best. For the level of increase requested (nominally to $60M), the Fund would have been able to award all proposals being graded, on average, in the top 5–10 % of international research proposals (i.e., an average grade of 2 or less), in addition to those already funded. This increase would have boosted the success rate to ~14 %, and had significant effects on the type of research being supported by the Fund, and, to a lesser extent, the research population represented by Marsden.

For the 2005/06 round, including these, "Excellent"–"Outstanding" but unfunded proposals would have broadened the research portfolio of the Fund (see table XX for a selection of the disciplines represented by this group).

Table 1. Disciplines and subjects for "Excellent" unfunded proposals in 2005, which were not represented in the contracts for that year.

Panel	Disciplines and subjects
Biomedical Sciences	Sensory systems; Peripheral nervous system
Cellular, Molecular & Physiological Biology	Invertebrate biology; Phycology; Microbial ecology; Microbial genetics; Cell neurochemistry; Membrane biology; Cell metabolism
Ecology, Evolution & Behvaiour	Animal reproduction; Animal systematics, taxonomy and phylogeny; Palaeontology
Earth Sciences & Astronomy	Soil chemistry; Soil physics; Geomorphology; Palaeontology
Humanities	Aesthetics; History: Pacific; New Zealand cultural studies; Cultural theory; New Zealand literature in English
Mathematical & Information Sciences	Software engineering; Programming techniques
Physical Sciences & Engineering	Turbulent flows; Fluid physics; Colloid and surface chemistry; Transition metal chemistry; Sensor (Chemical and bio-) technology; Fluidisation and fluid mechanics; Cell metabolism
Social Sciences	Health, clinical and counselling psychology; Social and community psychology; Tourism; Political economy; Economic development and growth; Microeconomic theory; Pattern recognition

Funding this group would also have made the Fund more inclusive, in that it would have lifted the proportion of female PIs from 27 % to 30 %, while the proportion of Maori PI's would have more than doubled.

OUTPUT CLASS 4 - SUPPORTING PROMISING INDIVIDUALS

JAMES COOK RESEARCH FELLOWSHIPS

OVERVIEW

The James Cook Research Fellowships are awarded to "forward thinking" researchers who will make a significant contribution to New Zealand's knowledge base. The scheme was established in 1969, discontinued in 1991, and then re-instated under Royal Society administration in 1996.

The Fellowships allow New Zealand's best researchers uninterrupted time to concentrate on their chosen research for two years without the constraints of administrative and teaching loads. This allows Fellows to focus a lifetime of study and scholarship on issues that advance New Zealand's role in knowledge creation. For most, the two years have been totally transformative and have led to some impressive achievements (see highlights below).

The James Cook Research Fellowships are awarded, as funding permits, in the following categories:

- Biological sciences (including biotechnology);
- Engineering sciences and technologies.
- Health sciences;
- Physical sciences (including chemistry, geosciences, mathematical and information sciences);
- Social sciences/Research of relevance to the peoples of New Zealand and/or the Southwest Pacific.

The Fellowships are offered in rotation among the disciplines, with two or three awarded each year. The Terms of Reference state that the term of the Fellowship will be two years.

Applications in the areas of Health Sciences, Biological Sciences (including Biotechnology), and Social sciences/Research of relevance to the peoples of New Zealand and/or the Southwest Pacific were called for in early 2006 for a start in March 2007.

During 2005/2006 there were eight active James Cook Research Fellowships and these are listed in Appendix 3.

Funding provided by MoRST has remained at $720,000 since 1996, a decline in real terms of 20 %.

HIGHLIGHTS

Three Fellows finished their Fellowships within the 2005/2006 period; one of these Fellows, Associate Professor Andrew Pullan finished a third-year extension and highlights of his Fellowship after 2 years' research were documented in some detail in last year's PAR.

Professor Ian Pool from the University of Waikato held a Fellowship from 1 April 2004 to 31 March 2006. In his final report he stated:

> *"Being on a James Cook was inspiring. It exposed me to contemporary policy and theoretical debates. It allowed me also to reflect on their implications for the empirical study that was the programme core. Finally it permitted me to be highly productive…… My James Cook research was greatly enhanced by working with others, internationally and in New Zealand."*

The overarching goal of Professor Pool's Fellowship was to produce a demographic history of the different peoples of New Zealand and thus to fill a significant knowledge-gap between good available histories (e.g. Belich's; King's; Hawke's), and his own Te Iwi Maori (Auckland University Press, 1991).

As a principal research focus, the programme addressed a theme of adaptation versus selective migration: the degree to which the different populations have had experiences unique to their time in New Zealand, including the way policy shapes these, as against importing behaviours and norms from source societies. It quickly became evident that the family was the most important issue, but that there were severe knowledge gaps for New Zealand. Thus attention was given to researching and writing a book on the family of which Professor Pool is the senior author. He has completed almost all the data analyses, and some rough drafts of chapters for a more "general book" on New Zealand's demographic history plus a rethink of Te Iwi Maori that has been peer reviewed and is at Auckland University Press, for release in November 2006.

Professor Pool's tenure has been very productive with one co-authored book, 2 co-edited books, 2 monographs, 12 refereed papers, 10 published discussion papers, 19 published conference papers, 10 invited seminars presented, and 2 talks to parliamentarians, 1 TV interview, 2 radio interviews and numerous articles in metropolitan and regional papers.

EVALUATION

AGE, DISCIPLINE AND STATUS

Of the 31 Fellowships awarded since 1996, the average age on starting the Fellowship is 51 years, spanning the range 38 to 67 years with half in the 40 to 50 age category. Three of the Fellows have been women. 75 % of the fellows have been employed by universities. In total the discipline split has been as follows:

6 in Biological Sciences;
4 in Engineering;
5 in Health sciences;
6 in Physical sciences;
4 in Research of relevance to New Zealand and/or South West Pacific;
6 in Social Sciences.

Since receiving James Cook Research Fellowships, 6 recipients have risen to Professorial or Emeritus Professor status, 6 recipients have been elected to Fellowship of the Royal Society of New Zealand, and one to Fellowship of the Royal Society (London).

An institution also receives a great deal of prestige when a staff member is recognised for research excellence by the award of a Fellowship. The research undertaken maintains international credibility and standards. This is important for maintaining standards of universities in New Zealand and for the reputation of the individual researcher.

FUTURE INVESTMENT PRIORITIES

The James Cook Research Fellowships demonstrate that enabling our best researchers to undertake research and analysis of international stature provides a massive return on Government investment in people.

The remarkably high productivity of the fellowship scheme makes the scheme very cost-effective. The international collaborations and extended networks provide opportunities for post-docs and researchers to come to New Zealand for training, and vice versa for young researchers seeking employment overseas. Collaborations with, and the training of, Ph.D. students and post-docs by Fellows benefits the future skills and knowledge of researchers. The public recognition of research is increased, with international and local media interest in Fellows.

The Society has made a recommendation on the future of the fund to MoRST, separate from this PAR.

NZ SCIENCE, MATHEMATICS AND TECHNOLOGY TEACHER FELLOWSHIPS

The NZ Science, Mathematics and Technology Teacher Fellowships have grown significantly over the past five years. In the last school year we have 59 teachers released to work in research and technological practice with 89 host different organizations. In 2006 there were 64 Teacher Fellows. Of the 59 in 2005, all but two returned to teaching[18].

Our triennial survey of past Teacher Fellows clearly demonstrates the value of the scheme. Teachers, hosts and schools (Principals and/or Heads of Department) almost unanimously agreed that the scheme is achieving its objectives. More than 90 % of the Teacher Fellows surveyed agreed that their fellowship had enhanced relevant skills, subject understanding, and their knowledge of suitable careers. The majority of Fellows also reported their experience had positively impacted on their teaching practice.

Teacher Fellows were found to have communicated their fellowship experience to a wide range of audiences. The majority stated that they applied the skills and/or knowledge gained through the Fellowship to their classroom programmes (88 %), their schools (81 %), and the wider education, and local, communities (70 % and 55 %, respectively). This year RSNZ initiated the Sharing the Learning programme of professional development workshops for teachers given by past Teacher Fellows. To July 2006 there have been eleven workshops by ten Teacher Fellows, ranging from Boxes – modern cargo handling practice and impact on economy and society to a talk on the use of slugs. In addition, at least forty two workshops were given by Teacher Fellows at the nine subject association conferences in 2005. We always find that there are a disproportionately greater number of workshops given by Teacher Fellows at such conferences. We intend to develop and strengthen the Sharing the Learning programme so that it becomes an established and recognized programme of professional development in pedagogical content knowledge for teachers. This too will fill a gap in the professional development available for teachers which has focused on assessment and behavioural management rather than pedagogic content for the past decade at least.

There are still areas which remain under-represented in the scheme. The prime one is schools of low decile rating. While the rate of award has generally been greater for teachers from low decile schools, there is a skewing to the higher decile rating. Primary teachers are also under-represented[19]

We are told that many teachers are inhibited from applying by challenges presented in the application process; having to find and initiate contact with a host organization, the detail required in project planning, the difficulty in foreseeing the opportunities that may arise, the difficulties of finding suitably qualified relieving teachers and the disruption to students caused by staff change; this is especially so in low decile schools. While we cannot assure a source of relief teachers, we can assist and support in overcoming the other barriers. We are developing a sub-set of Teacher Fellowships in which the RSNZ works with identified host organizations to prepare projects into which appropriate teachers can be placed for periods of one to two school terms.

[18] One fellowship terminated due to unsatisfactory performance.
[19] RSNZ has carried out an evaluation of the Teacher Fellows scheme for MoRST - "Better teaching by doing: a mixed-method evaluation of the NZ Science, Mathematics & Technology Teacher Fellowship programme" (2006)

Teachers will be placed in current research or technological projects in order for them to:

- enhance their understanding of and positive attitudes towards science, mathematics, social sciences and technology, and develop both personally and professionally;
- enhance their awareness and understanding of the applications of science, mathematics, social sciences and technology;
- enhance their awareness and understanding of careers involving science, mathematics, social sciences and technology, and promote career options in these areas to their students;
- communicate their learning in science, mathematics, social sciences and technology to their colleagues.

Under this programme, school Principals will be able to identify staff that would benefit from such placement while RSNZ could be proactive in targeting areas of under-representation. The first of these scholarships will be trialled in the 2007 school year. No increased funding is sought for this.

TALENTED SCHOOL STUDENTS TRAVEL AWARD

The administration of this fund to support school students, providing funds to help cover the direct travel costs to nationally recognised science and technology based events outside New Zealand continues to be very rewarding and satisfying. We were able to provide some support to all eligible applicants in 2005/06 and expended the total amount of the fund. However, while support was provided to all eligible, the funds disbursed were only 81% of the funds requested, i.e. applicants to the fund generally received only a portion of their requested support.

Students were selected on the basis of:

- Demonstration of engagement in scientific or technological practice;
- Contribution to activities outside the classroom;
- Academic performance in subjects relevant to the proposed project;
- Communication skills; and
- Ability to be a good ambassador for New Zealand

> *"I am sincerely grateful to all parties who have made this trip possible. On a more general note, I'd like to say that such trips are important as they encourage innovative scientific endeavours, social adaptability, and an appreciation for the complex world we all share. In addition, being thrown out of one's comfort zone inevitably leads to a better understanding on oneself. For me, this two week visit to Beijing embodied an ideal future of having progress and global cooperation. Such journeys emphasise that thrilling futures lie ahead, should young Kiwis choose to grab them with both hands"*
>
> Riddhi Gupta – Pakuranga College

77 students, ranging from Year 7 to Year 13, 24 female and 53 male, were supported to attend 14 international science and technology events in 10 different countries. Further detail on the events in which students participated is given in the report on Promoting an Innovation Culture.

Geographical Distribution			
Northland	14	Wellington	6
Auckland	33	Nelson	=
Bay of Plenty	4	Canterbury	5
Waikato	2	Otago	=
Hawkes Bay	1	Southland	2
Manawatu	1		

DECILE RATING

Applications were received from applicants attending schools ranging from Decile 2 to Decile 10[20].

Decile Rating	1	2	3	4	5	6	7	8	9	10
Decile of successful schools	0	1	2	1	1	4	13	12	12	28

[20] 3 schools' decile ratings were not available on the TKI website

OUTPUT CLASS 5 - INTERNATIONAL SCIENCE AND TECHNOLOGY LINKAGES

The Society continues to make significant contributions to the Government's support for increasing participation in global connectedness through the management of the Bilateral Research Activities Programme (BRAP); the International Conference Fund; the memberships of 32 international scientific unions and their associated committees; and the dissemination of S&T information and opportunities from the Ministry of RS&T's NZ Counsellors in Brussels and Washington (via the Co-Lab website). Contributions are also made through the Society's own Memoranda of Understanding with various international organisations; with the Ministry of Foreign Affairs and Trade; and our involvement with the Wellington-based Embassies.

Tangible benefits accrue to New Zealand from its international links in RS&T and allowing us to contribute to, and draw from, the global effort. We must continue to develop excellent, focused and active overseas links.

BILATERAL RESEARCH ACTIVITIES PROGRAMME

OVERVIEW

The Bilateral Research Activities Programme (BRAP), administered by the Royal Society, is a part of the overall International Linkages activity of the Ministry of RS&T. The primary purpose of the Fund is to support the development and enhancement of international research relationships with an emphasis on supporting new activities and relationships. The Fund facilitates bilateral research through funding New Zealand resident researchers to travel overseas or for overseas researchers to visit to work on joint research projects.

The Fund is contestable and funding is keenly sought from the NZ research community. Since 1998 when the Royal Society began to administered the Fund there have been 867 recipients with a total grant value of almost $3.4m. 48 different countries have been involved.

HIGHLIGHTS

The following are examples of successful mainstream funding bids as a direct result of initial Bilateral Research Activities Programme projects.

Development of remote sensing applications for monitoring carbon dioxide and heat fluxes in volcanic regions
Dr Cindy Werner of GNS Science received three year funding to collaborate with Dr Giovanni of the Osservatorio Vesuviano, Istituto Nazionale di Geofisica e Vulcanologia, Napoli, Italy and this collaboration was instrumental in the success of a $300k EU Framework Programme 6 grant for GNS Science.

Advanced Surface Technologies for Magnesium Alloys
Professor Wei Gao of the University of Auckland collaborated with Professor Yuan Hao, University of Technology, Lanzhou, Gansu, China and others and Professor Gao has been successful in obtaining a 3 year grant of $1.55m from the FRST managed International Investment Opportunity Fund.

In addition to the above Dr Jane Kay of Dexcel Limited, a Hamilton-based company, received three year funding from BRAP to collaborate on "improving the energy status of cows in early lactation" with Assistant Professor L Baumgard, of the University of Arizona, Tucson, Arizona, USA and as a result of this research Dr Kay has received the runner-up award in the distinguished "Adding Value to Nature" category of the 2006 MacDiarmid Young Scientist of the Year Award.

PROGRESS AND ACHIEVEMENTS EVALUATION

An extensive evaluation of the programme was carried out in 2004. The most commonly expressed statements were that the application process was too laborious, or concerns were noted regarding the value of an award, with half of these respondents explicitly linking the two, i.e. the effort required for application was too great for the level funded.

For the 2005-06 year the application process was revamped and applications are now submitted electronically. The process also has a greater emphasis placed on the sign-off of a set of eligibility conditions and specific criteria. The latest anecdotal evidence suggests that the application process is now much easier.

The Programme is contestable and always significantly over-subscribed. Applications are called for twice yearly with a selection panel of 6 eminent researchers. In the year to 30 June 2006 the Society received 194 applications. 47 % of the applications were successful with 31 % of the applications receiving multi-year funding. The average size of a grant was $4.5k and 18 different countries were involved.

Appendix 4 includes data on the trends in the number and value of the grants over the past six years and the distribution of funds. The proportion of awards going to universities rather than the CRIs has increased compared to previous years. The private sector is allowed to access the Programme but it is very limited in applying to the Programme.

For the relatively small amount of investment the Programme has many benefits to New Zealand and these include:

- Workshops held for other NZ researchers when the overseas researcher is hosted by a NZ institution;
- Contribution to the recognition worldwide that NZ is a centre of innovation by showcasing its scientific abilities and attributes;
- Access to international knowledge and to state-of-the-art equipment; and
- Published results

The annual indicators for the fund clearly demonstrate the high outputs from the grants, and the impact the grants have of further mainstream funding opportunities (see Appendix 4).

POLICY IMPLICATIONS AND FUTURE INVESTMENT PRIORITIES

Established in 1994 the Bilateral Research Activities Programme of the ISAT Linkages Fund provides the NZ science and technology community with the opportunity to apply for funding to assist them with collaboration with international colleagues. International collaboration gives NZ a presence in the world as a centre of innovation and BRAP assists in show-casing our research capabilities. The two-way flow of information allows NZ to engage with the 99.8 % of research that is not done in NZ. It also provides access to world-class talent, state-of-the-art equipment, investment to build NZ human, physical and research capital.

The Society continues to develop its own strong relations with world-wide research organisations particularly in the Asia-Pacific region and appreciates that the Ministry is also developing policies and mobility in these areas as well. Therefore, to maintain NZ's presence in world-wide research and to increase the mobility among all research players we propose that the Bilateral Research Activities Programme be expanded by 25 % over the next three years.

OUTPUT CLASS 6 - PROMOTING SCIENCE AND TECHNOLOGY

COMMUNICATION OF SCIENCE

Since it was established in 2001, the Royal Society Communications Unit has shown particular flair and capability in the following areas:

- Thinking up ideas and growing them into national umbrella science education promotions, e.g. Transit of Venus, and BIG Science Adventures, the nationwide secondary school video competition.
- Leading and coordinating national S&T celebrations, such as World Year of Physics (2005), and the 50th anniversary of DNA (2003).We develop and directly manage key events in these celebrations.
- Fostering relationships with journalists, providing them with in depth briefings such as the VIP science classes in collaboration with Victoria University thus promoting New Zealand science and scientists in the media.
- Working with Radio New Zealand to increase science coverage, e.g. broadcast lecture series, Kim Hill's regular slot with Paul Callaghan and her recent trip to the UK to interview Britain's top scientists.
- We have been particularly successful at developing relationships with the arts community, e.g. Are Angels OK? which was an idea we initiated, helped manage and did most of the promotion for. The impact and coverage of this project has been remarkable, and it has had ongoing benefits, e.g. ten writers who are now well versed in scientific ideas, and interested in producing more work based on them.

This last year as been dominated by Year of Physics activities. The Are Angels OK? anthology was published in May. We raised the money to take a group of New Zealanders to present at the Cheltenham Science Festival, Cambridge University and the UK High Commission. Kim Hill from Radio New Zealand was part of the presentation and she took the opportunity to interview twelve of Britain's top scientists, including Sir David King and Martin Lord Rees. These interviews were suggested and facilitated by the Royal Society. Their broadcast drew an immediate response, with several thousand people downloading the interviews.

A significant success has been the BIG Science Adventures video competition which brought together students and research scientists in a very meaningful and productive way. Teams of secondary schools students had first to produce five minute documentaries on a local science story. The best were then each assigned to the six BIG Science Adventures, led by scientists carrying out current research. Each location was remote and beautiful – an inspiration in itself. They produced documentaries of their field trips and judges selected the best of these to go to the Antarctic. Wellington High will produce another documentary of their trip to the Antarctic, which will be a valuable resource for celebrations of 2007 Polar Year. These programmes have educational depth and richness, and have resulted in tremendous publicity for New Zealand science. TV1 and TV3 News each covered the competition, and the winning team.

Thanks to significant funding by Freemasons NZ, this video competition will continue in 2006/7, the prize a trip to the Greenland ice sheet. The focus of the competition will be climate and energy.

A real hit has been the two VIP science classes we ran in October/November and March/April for key journalists (Kim Hill, Eva Radich, Melanie Thornton, the Listener science journalists), publishers, playwrights, and artists. We supported Victoria University's conference on climate

change by running a seven week course on climate change and energy in the period leading up to the Conference. The course was run in association with the Physics Department at Victoria University. More courses are planned.

Good ideas leverage money and the willing cooperation and in kind contributions of other organizations. Year of Physics and BIG Science Adventures are two excellent examples. The brought a lot of benefits to the science community, presenting scientists as exciting, interesting, even rather glamorous individuals.

The media coverage generated by all this activity cannot be overemphasized. Royal Society activity is directly or indirectly generating a third to a half of all local science and technology news coverage.

The amount of money the Ministry has contributed to the Royal Society's communications/ promotions area has substantially diminished over the last 4-5 years. We would like the Ministry to invest in staff time to promote New Zealand science in the media - a role we are uniquely placed to undertake because of our national overview, ability to cover all science and technology areas, and reputation as a source of high quality information. Umbrella public science education promotions such as $E=mc^2$ are also effective ways of stimulating additional media coverage, and providing a stage for our scientists to showcase their work. Whilst we can leverage money and other contributions, we need seed money to make them happen. Next year we will be starting to work on a major two year celebration of evolutionary biology - 2008/9 is the 150th anniversary of Darwin's theory, and 200 years since he was born. This is a chance to profile all the New Zealand researchers whose work, past and present, stems from his theory of evolution.

We seek to fund one middle level communications position, and a small amount of operational expenses associated with media promotion and establishing a New Zealand Darwin celebration on behalf of the science community.

YOUNG ACHIEVERS

Our database has increased again this year and we now have 1157 young achievers[21] in sciences and technology ranging from Year 7 to post-graduate ages. We send a monthly electronic newsletter to all students on the database. This informs students about available scholarships, competitions, visiting scientists and general science and technology news. The database has the potential to grow into a resource which could contain thousands of interested and budding student scientists.

We seek to develop interactivity in the Young Achievers' website where students could communicate science questions, issues, and research. News input from organisations such as CRIs, Universities, Zoos and Observatories could also be included. This platform would enable students to engage with researchers and learn of current NZ research and its value. It would require a dedicated person to manage such a website.

We seek also to increase the activities available for Young Achievers through local coordinators who could work with local students arranging field trips, visits to research organisations, forums, and workshops. Provision of such local facilitation and national coordination would require 1.5 FTE. Such activities will excite and engage young New Zealanders in science and technology in NZ. They, and their families, will learn of the world-class research that is undertaken in New Zealand, the benefits of such research, and the value of public support for research.

The Talented School Students Travel Award has proved hugely successful and is supporting a large number of school students to international events. The RSNZ Travel Award also supports

[21] There are 657 female and 530 males on the database.

at least 50 tertiary students each year to their first international conference. We wish to extend this to enable NZ to participate fully in the Lindau Nobel meeting and to assist teachers to attend international conferences which would benefit their profession. It is difficult to see where such support could be made available within the framework of existing contestable funds. A change in terms of reference in some of the international contestable funds would be required to accommodate such support.

The BAYERBoost scholarships give senior secondary school and undergraduate tertiary students experience in environmental research or restoration during their summer break while providing financial support for further study. The scholarships have proved extraordinarily successful in 2005. Interest in this programme in 2006 has been at a considerably higher level. This is an excellent example of the Society using privately-sourced funds to provide a much needed and highly valuable programme. Government support would increase the benefit of this programme and enable leverage of increased private funding. Expansion of this project would require 0.5FTE.

The Olympiad movement continues to grow. This year teams prepared for the Biology, Geography, Infomatics Olympiads as well as the traditional Maths and Chemistry events. New Zealand has been invited to participate in the inaugural Earth Science Olympiad next year, and there are also the Physics and Junior Science Olympiads available. There is growing collaboration between each Olympiad organising committee and an increasing number of students involved in Olympiad activities and aspiring to make the team to compete against their international peers. While the Talented School Student Travel Award is able to assist with some travel costs for the students, centralised administration for all Olympiads and support for their activities will enable greater reach into schools and provision of opportunity for many more students, giving many a higher goal than NCEA achievement. Support from the Ministry of Education enabled some of this activity and we hope to develop that support through ongoing discussions with Government.

THE SOCIETIES OWN ACTIVITIES IN EDUCATION – INSPIRING OUR YOUNGER GENERATIONS

All New Zealanders at school or in tertiary education should be able to develop their knowledge, skills and understandings to the best of their potential and experience success. While literacy and numeracy underpin achievement, all students should be provided with inspiring and stimulating experiences in science and technology so that New Zealand has a scientifically and technologically literate and aware community who can make decisions based on evidence.

It is also important at school level, especially primary and junior secondary, that sciences and technology are well integrated with other essential learning areas in order to maximise the time engaged in formal learning and to demonstrate that life is not compartmentalised into school subjects.

RSNZ's main aims in education are therefore to:

- excite and inspire young people in science and technology
- increase teacher enthusiasm, knowledge, skills
- increase participation in the sciences and technology in tertiary education

While our Government funded activities enable us to address these aims, our privately supported activities add depth and breadth to the range of programmes available to students and teachers. We are also particularly keen to encourage integration of activities for students so that they are able to maximise benefits from their work.

CREST

CREST (Creativity in Science and Technology) Awards is a national scheme that provides a framework for students to carry out projects in science and technology, based on individually chosen issues that are of significance in their lives. All students are encouraged to access the expertise of consultants and assessors in the field relevant to their project, and so links are made between schools and the research and technological communities of practice.

BP CHALLENGE

The BP Challenge, administered by the Royal Society in partnership with BP New Zealand, challenges teams to design and develop 'solutions' to problems. In 2005 we supported 91 schools and approximately 8,000 students. These events are often community events bringing together a large audience of parents and interested adults

The BP Challenge was evaluated in 2005 and the findings clearly demonstrate very high levels of teacher satisfaction with the programme, student enjoyment of the activities and the recognition of the learning opportunities in the Challenges.

NATIONAL WATERWAYS PROJECT – ENVIRONMENTAL MONITORING AND ACTION PROJECT

Environmental education continued to be delivered by RSNZ until December 2005 through the National Waterways Project, funded by the Ministry of Education's LEOTC. This is now part of the Environmental Monitoring and Action Project scheme that continues to encourage environmentally sustainable practice reminding students they can make a difference to the world we live in.

GENETHICS

genETHICS is a unique competition that encourages secondary school students to discuss ethical issues associated with human genetics research. The programme is now secure thanks to support from Toi te taio; New Zealand's Bioethics Council and the NZ Organisation for Rare Disorders, we aspire to greater support to provide for a substantial award for finalists; this award would involve them in interaction with researchers and ethicists.

INTERNATIONAL EXCHANGES

The Society selects students and teachers for a number of international opportunities for participation in science and technology. Over 75 students travelled overseas in 2004. Participants are partially supported through the Talented School Students' Travel Award and also through sponsorships generated by RSNZ. We are able to leverage Government support to gain a further $20,000+ of private support each year.

HELIX AND SCIENTRIFFIC MAGAZINES

The Society distributes the CSIRO magazines Helix and Scientriffic, two of the best science and technology magazines for children.

GENESIS ENERGY REALISE THE DREAM

Genesis Energy Realise the Dream is our 5 day national celebratory and educational expo held at the end of the school year for high achievers in research and technological practice (sciences, mathematics, social sciences and technology). In 2005 we brought together 32 young New Zealanders who had carried out work ranging from developing video games to discovering fluorescent substances in worms, from producing a rapid charger for batteries to researching the efficiency of different rotors for wind generation of electricity, and from the health of Wellington Harbour to the growth of garnets in Westland rocks.

The programme for 2005 included workshops for the participants on presentation and speaking skills, intellectual property, visits to research and technological organizations, demonstrations, visits to sites such as AgResearch and the Karori Sanctuary and a celebratory dinner.

Genesis Energy Realise the Dream recognises and rewards outstanding performance by young New Zealanders, and provides an incentive for them to carry out research and technological practice.

OUTPUT CLASS 7 - JOURNAL PUBLICATIONS BY THE ROYAL SOCIETY OF NEW ZEALAND

OVERVIEW

For research to be useful it must be published. The national science journals published by the Royal Society of New Zealand exist primarily to fulfil that function.

Our eight journals make New Zealand's current research efforts available for use. Our journal digitisation project will ensure that the history of all the research that has underpinned the development of this country is accessible to all.

Why does New Zealand need its own national research journals? Our journals:

- validate research of benefit primarily to New Zealand researchers
- make available the scientific work undertaken by New Zealanders
- maintain the credibility of New Zealand science internationally
- raise the scientific profile of New Zealand, and help attract world quality researchers to work in New Zealand
- are a measure of New Zealand's scientific progress
- promote a sense of community in New Zealand's scientific scene
- foster contact between New Zealand researchers and those working overseas
- preserve New Zealand's scientific knowledge
- provide a database for future progress
- provide a vehicle of publishing papers primarily of regional interest and value
- are extremely cheap to publish in comparison to the cost of undertaking the research itself

Government partly supports the publication of our eight New Zealand primary research journals through an annual contract to the Royal Society. This contract is equivalent to less than 0.1 % of the cost of all Government-funded research, yet it provides a key link in the process of transfer and utility of that knowledge.

Seven of the journals are Government-owned and published by the Royal Society. They are largely regional in scope but have a global audience, particularly within the Southern Hemisphere and western Pacific United States. The journals are:

New Zealand Journal of Agricultural Research
New Zealand Journal of Botany
New Zealand Journal of Crop and Horticultural Science
New Zealand Journal of Geology and Geophysics
New Zealand Journal of Marine and Freshwater Research
New Zealand Journal of Zoology
Journal of the Royal Society of New Zealand
Kōtuitui: New Zealand Journal of Social Sciences Online

The Royal Society of New Zealand is the ideal publisher of the nation's journals because it is a well-recognised body with close ties to Government, but which is independent of any science provider.

The Society has introduced electronic manuscript handling to benefit reviewers and authors and to increase the speed of publication. In particular, we have joined the move towards full open access publishing to make New Zealand research available to all.

OPEN ACCESS

Open access provides authors from countries such as New Zealand, who are geographically isolated from their European and American counterparts, with an equal footing for the dissemination of their articles in the worldwide marketplace. Consequently, the results of our research efforts are widely disseminated to a more targeted and relevant audience. This increases the impact of articles, as testified by the 5% monthly average growth rate in the number of hits on our journal websites.

Our journals are currently funded through a hybrid system which includes subscriptions, Government funds, and author page charges. The author page charge increased in 2006 from $50 to $70, and waivers for non-funded submissions from overseas authors were removed. Open access requires that publication be ultimately funded by the Government or authors in lieu of all subscription revenue. A large number of countries, and organisations within countries, have realised the benefits of open access. For example, the Wellcome Trust and the Royal Society London in the UK, the US-based PubMed Central and Public Library of Science (PLoS), and public agencies in Brazil, Japan, India, China and others.

DIGITAL ARCHIVES

Digital archives provide greater online presence, increase citations, increase our distribution options, and help create a complete and permanent record of our publications. Our efforts to digitise back issues of the journals are an important and cost-effective way to increase the impact and utility of research that has already been paid for.

With external funding provided through the DoC Terrestrial and Freshwater Biodiversity Information System (TFBIS) Programme, we have converted back issues of all journals back to 1994. In addition, all issues of New Zealand Journal of Botany and New Zealand Journal of Marine and Freshwater Research have been digitised to Vol. 1. Other assistance has been given by the Geological Society of New Zealand and the New Zealand Entomological Society. We have invited all parties with an interest in furthering our digitisation efforts to donate to the cause ($350 will enable four issues of a journal to be digitised).

In addition, The National Library of New Zealand is presently completing the digitisation and provision of online access to the early publications of the Royal Society, the Transactions and Proceedings, dated from 1868 to 1961. Together, our programme and that of the National Library will ensure a continuum of digital access from the currently published journals back to the earliest archival material under the aegis of the Royal Society.

HIGHLIGHTS

NEW SOCIAL SCIENCES JOURNAL

Kōtuitui: New Zealand Journal of Social Sciences Online was newly established in July 2005 in response to encouragement from the Social Science community and with funding from MoRST. It is a prototype of electronic only, open access publication of research for the Society intended to provide useful indicators for the other research journals as they move towards full open access.

Editorial and administration processes for Kōtuitui are shared between Massey University in Auckland and Victoria University of Wellington, using the Society's database and journal management system, and a system of honorary editors and associate editors and with the assistance of an Editorial Advisory Board.

The first issue of Kōtuitui was published in May 2006, and is available at http://www.rsnz.org/publish/kotuitui/

PROCEDURES

We continue to publish the journals in both print and online forms owing to the requirements of botanical and zoological taxonomy for new names to be published in paper form. Subscriptions currently remain necessary to cover the printing and distribution costs. The decrease in subscriptions experienced over recent years in response to online access may now be levelling off (see Appendix 5). However, we will continue to examine all ways of increasing revenue and reducing costs while improving the quality and performance of the journals.

Some developments in our procedures over the last 12 months include:

- improvements to our electronic manuscript handling and tracking procedures, including submission, reviewing and proofing processes
- publishing online papers between 2 and 6 six weeks before print publication
- publishing papers online individually as they become available, thereby reducing their times to publication
- extending the digitisation of archival issues of all journals to become freely available online

EVALUATION

The New Zealand journals play a continuing and vital role in the dissemination of New Zealand research, and the national journals published by the Royal Society constitute a significant proportion of all New Zealand authored papers that are published worldwide. The improving Impact Factors of the journals show that the quality of the journals continues to increase under the Society's management.

The New Zealand journals also show strong rankings in relation to other international journals in their respective fields, a measure of their relevance compared with the others. In 2006, the Journal of the Royal Society of New Zealand was regarded statistically by the ranking organisation (ISI) to have "a significant impact in the field of Environment & Ecology". Appendix 5 includes data on the impact factors, rankings, outputs and subscriptions.

NON-JOURNAL PUBLISHING

The Society publishes additional books and bulletins on an occasional basis, which are usually fully funded projects arising from relevant conference proceedings or discussion documents. No MoRST funds are used in these publications. However, the activity constitutes an important extension to the work of the Publishing unit and adds credibility to its name as a major publisher of relevant New Zealand science. There is a constant demand for many of these publications that have been produced in the past.

OUTPUT CLASS 8 - OTHER INTERNATIONAL ACTIVITIES

OVERVIEW

In addition to administering the Bilateral Research Activities Programme, the Royal Society undertakes many activities to support New Zealand's international research links. New Zealand is a country with a relatively small but sophisticated scientific community, far from the main centres of scientific and technological endeavour and deriving much benefit from international scientific and technological contacts.

PROGRESS AND ACHIEVEMENTS EVALUATION

Through the funding provided by Ministry in 2005-06 the Society was able to:

- Fund to 14 international conferences held in NZ;
- Fund to 10 workshop/symposia held in NZ;
- Subscribe to 32 scientific unions or associates;
- Partially fund 10 delegates to attend their respective general assembly and/or congresses; and
- Maintain the Co-Lab website that offers European information and opportunities to the NZ research community.

HIGHLIGHTS

INTERNATIONAL CONFERENCE FUND

On behalf of the Ministry the Royal Society provides funding to assist NZ organisations and institutions to host major international conferences in NZ. International conferences held in NZ enhance our research, science and technology credibility, promote international recognition of NZ as a centre for innovation, and assist researchers to develop relationships with world leaders in their research areas.

The following is one sample of the conferences that received financial support from the International Conference Fund:

International Conference on Sensing Technology
The recent years have seen an explosive growth of research applied to sensing systems in the areas of life sciences, physical sciences and engineering. Sensing technology is a huge area by its nature. Its applications range from medical diagnostic to industrial manufacturing and to national security, prevention of natural disasters and terrorism. This requires inter-disciplinary collaboration between scientists and engineers to solve complex real world problems. Sensing circuits and systems are challenging the state-of-the-art circuit design, and cross-field collaboration is important for utilizing existing technologies.

The International Conference on Sensing Technology was held at Massey University, Palmerston North during November 2005. The conference enabled scientists, engineers and practitioners throughout the world to present their latest findings, ideas, developments and applications. The conference was very successful, attracting 150 participants with more than 70% from Australia, Austria, Canada, Czechoslovakia, France, Germany, India, Ireland, Italy, Japan, Malaysia, Singapore, South Korea, Spain, USA, United Kingdom, and Vietnam. The NZ participants included 12 students.

INTERNATIONAL SCIENTIFIC UNIONS

The Royal Society affiliates on behalf of NZ science to thirty two non-governmental international scientific unions and other organisations. Through this network of affiliates NZ scientists continue to be involved in policy making of international unions and also the scientific work of commissions and working groups.

At present 19 New Zealanders hold positions on international unions, scientific associates or commissions. Those holding senior positions are listed in Appendix 6.

CO-LAB WEBSITE

The Co-Lab website, established in June 2004, provides intelligent information to NZ researchers and their organisations on information and opportunities for engagement with overseas-based research programmes, particularly from the NZ Counsellor based in Brussels and those of the European Commission's Research Framework Programmes. The website continues to be very successful, with page views increasing monthly by an average of 12%, to 18,300 hits in July 2006. It is kept up to date on a daily basis. A fortnightly electronic newsletter is emailed to the strategic group established by MoRST.

THE ROYAL SOCIETY OF NEW ZEALAND

PROGRESS AND ACHIEVEMENTS REPORT
APPENDICES

INCORPORATING THE MARSDEN FUND COUNCIL REPORT ON THE MARSDEN FUND

NOVEMBER 2006

Promoting excellence in science and technology

APPENDIX 1 - MARSDEN FUND – SCOPE AND SCALE

The Fund has increased in size, almost, steadily since its inception 11 years ago and currently stands at $33.878 million following its increase of $3.40 million in the 2005/06 round.

Each year, approximately one third of the total budget becomes available for new projects from expired projects and new money allocated to the Fund. In 2005/06, funding of $35.0 million over the next three years was awarded to new contracts. Figure A1.1 shows the trend in allocation amounts and Government funding in recent years.

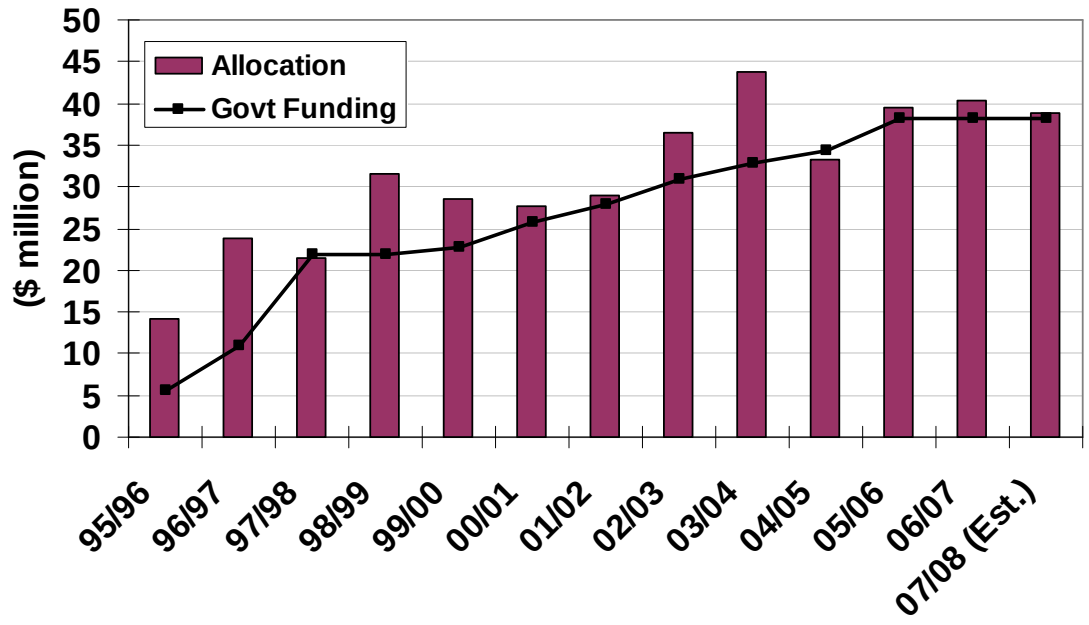
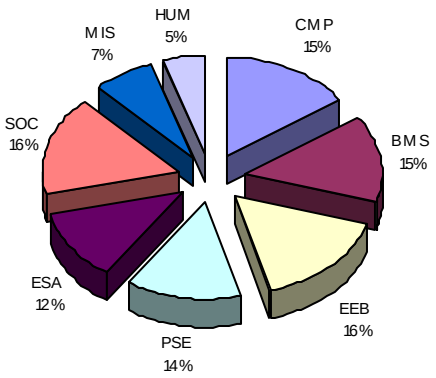


Figure A1.1. Funds allocated to new Marsden Fund projects

The distribution by research area of contracts commencing in the 2005/06 year, is shown in Figure A1.2. Note that the proportion of the Fund to allocate to each area of research is not predetermined, but is a consequence of the numbers of proposals received and their excellence relative to the proposals not selected.



The research areas are:
CMP - Cellular, Molecular & Physiological Biology;
BMS - Biomedical Sciences;
EEB - Ecology, Evolution and Behaviour;
PSE - Physical Sciences and Engineering;
ESA - Earth Sciences and Astronomy;
SOC - Social Sciences;
MIS - Mathematical and Information Sciences;
HUM -Humanities.

Figure A1.2. Funding by research area for new contracts in 2005/06

For these new research contracts, 46 % of the funding is for the medical and life sciences, 33 % for the physical sciences, earth sciences and mathematics, 16 % for the social sciences and 5 % for the humanities. The discipline spread is similar to previous years, except for the Social Sciences panel which has increased from 9 % to 16 % of the total in the last 5 years.

APPENDIX 2 – MARSDEN FUND – QUANTITATIVE INDICATORS AND QUALITATIVE ACHIEVEMENTS

BUILDING HUMAN CAPACITY

PRINCIPAL AND ASSOCIATE INVESTIGATORS

The Marsden Fund has supported established researchers by:

Funding contracts starting in the 2005/06 year that involve 104 principal investigators (all except six of whom are based in New Zealand) and 121 associate investigators (of whom 55 % are based in New Zealand).

Supporting contracts in the current year which involve 924 separate individuals as principal and/or associate investigators.

NEW AND EMERGING RESEARCHERS

The Marsden Fund invests heavily in emerging researchers. 24 Fast-Start contracts were awarded in 2005/06 to researchers who have had no more than 7 years of research experience since completing their Ph.D.

The Marsden Fund's contracts support approximately the same number of postdoctoral researchers as the NZ Science & Technology Postdoctoral Fellowships scheme which is administered by FRST. For the 808 contracts awarded between 1996 and 2005, funding has been available for postdocs in 43 % of them, providing the equivalent of 266 full-time 3-year appointments. In the 2005/06 year, the first year of new contracts requested support for 22 FTE in postdoctoral positions.

For the 808 contracts awarded between 1996 and 2005, funding has been available for postgraduate students in 57 % of them. In the 2005/06 funding round, the first year of new contracts provided support for 65.5 FTE in postgraduate positions.

Although the Fund gives support to those at a very early stage in their research career, recent years have seen a clear shift in the type of individual appearing in support roles for Marsden contracts. Since 2001, the level of Post-doctoral involvement has steadily declined, both in absolute terms and as a relative proportion of the FTE supported by the Fund. At the same time, this workload has been matched by steady increases in the proportion of contract FTE going to post-graduate students (Figure A2.1).

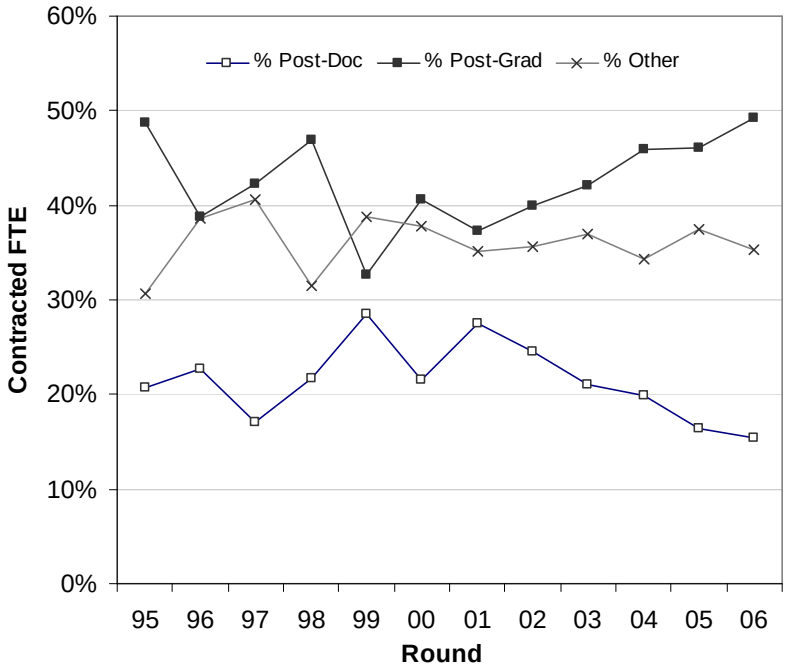


Figure A2.1. Relative proportions of the FTE contracted by Marsden standard grants going to post-doctoral fellows, post-graduate students, and all others

This trend is made more acute if Fast-Start contracts are included as only 2 have ever requested salary for a post-doctoral fellow, compared with 41 from 2001-2005 that have requested support for post-graduate students.

In 2005/06, 48 % of all principal investigators and 36% of all associate investigators are within just 10 years of completing their Ph.D. (that is, in most cases, are under 35 years of age). The participation of emerging researchers is significantly greater than would be expected from demographic considerations alone (Figure A2.2 and Figure A2.3). Five years ago, before the start of the Fast-Start scheme, 27 % of all principal investigators were within 10 years of completing their Ph.D.

Since 79 % of contracts are in the science area, this distribution for principal investigators has been compared with the distribution of ages of New Zealand scientists, from "Profiles – A Survey of New Zealand Scientists and Technologists"[1][2]. The data show that the number of younger principal investigators is significantly higher than could be expected on the basis of demographics alone. However, experienced researchers also play a significant role.

[1] Sommer, J. and D., 1997, "Profiles – A Survey of NZ Scientists and Technologists", The Royal Society of New Zealand

[2] Note: the horizontal variables (years since highest degree and age, respectively) have been matched by assuming that the highest degree is obtained at 24 years of age.

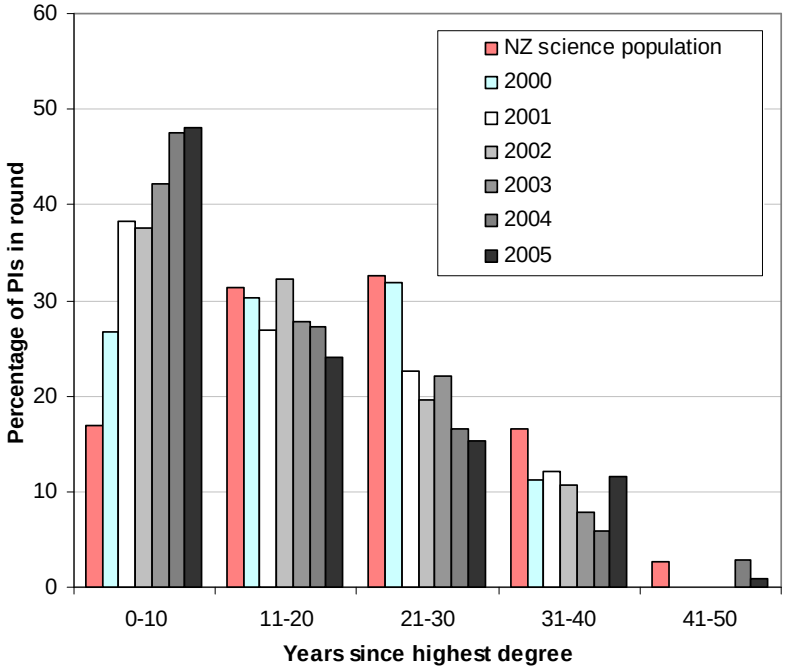


Figure A2.2. Experience of principal investigators (PIs) on contracts awarded from 2000–2005, as measured by the number of years since the principal investigator obtained their highest degree.

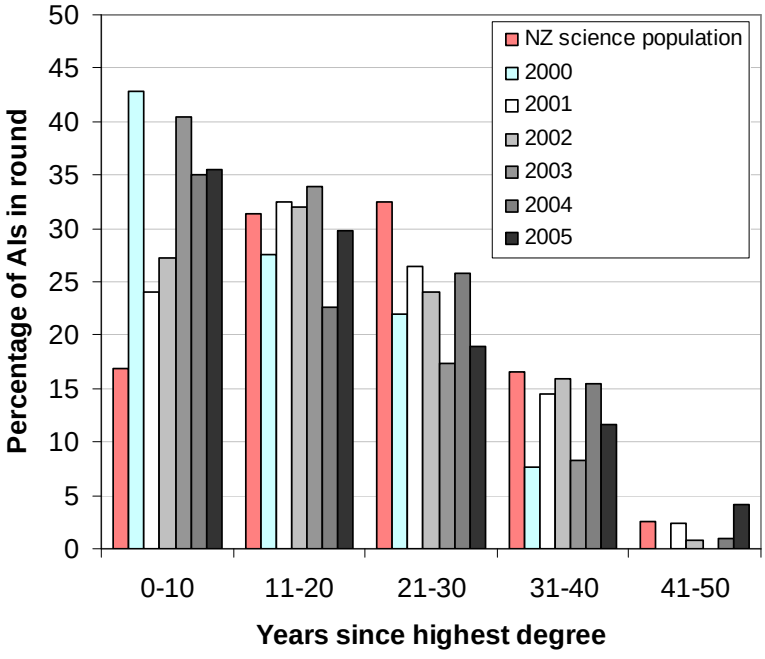


Figure A2.3. Experience of associate investigators (AIs) on contracts awarded from 2000–2005, as measured by the number of years since the associate investigator obtained their highest degree.

WOMEN RESEARCHERS

In 2005/06, 28 % of the principal investigators on successful applications are women, making this the highest year to date[3].

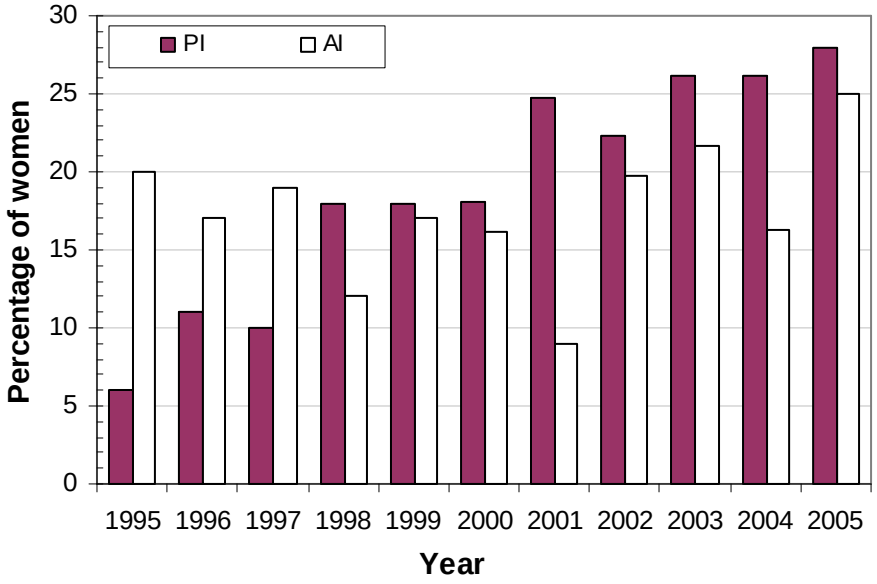


Figure A2.4. Percentage of principal, (PI) and associate (AI), investigators who are women.

MAORI RESEARCHERS

For contracts active in the 2005/06 year, Māori researchers contribute to 1.4 % of the contracts, although the percentage of principal and associate investigators who self-identify as Māori is 1.8 %. In the 1997 Royal Society survey (referred to above), 0.7 % of scientists identified themselves as Māori.

[3] Data from the 2001 Census shows that, excluding computer professionals, 27.5% of scientists are women. The corresponding figure for 1996 was 24.0%. Not all scientists are researchers.

SUMMARY-PEOPLE SUPPORTED IN MARSDEN CONTRACTS

Table 2.1. Participation in Marsden grants.

Building human capacity	**'99–'00**	**'00–'01**	**'01–'02**	**'02–'03**	**'03–'04**	**'04–'05**	**'05–'06**
Investigators – Number of separate individuals acting as principal[4] and/or associate[5] investigators on current contracts	660	729	769	791	923	896	924
Emerging researchers – Percentage of PIs on contracts awarded in the funding round who have received their highest degree within the last 10 years	26%	27%	38%	38%	43%	48%	48%
Postdoctoral fellows[6] – Percentage of standard contracts in the year's funding round which involve postdoctoral fellows	47%	44%	47%	47%	48%	46%	51%
Students[7] – Percentage of contracts in the year's funding round which involve postgraduate students	47%	70%	49%	57%	59%	65%	63%
Women – Percentage of female PIs on contracts awarded in the funding round	18%	18%	25%	22%	26%	26%	28%
Maori – Percentage of Maori PIs and AIs on contracts awarded in the funding round	1.6%	0.9%	4.0%	1.3%	5.6%	4.1%	1.8%

[4] PIs – Principal Investigators –researchers who lead the research, contribute the main ideas and are responsible, with their institution, for the achievements of the objectives and the management of the contract

[5] AIs – Associate Investigators – researchers who play a lesser role than principal investigators and sometimes are involved with onlylimited aspects of the work.

[6] Postdoctoral fellows – emerging researchers who have completed a Ph.D., usually within the last few years, and are employed on contract (often 2-3 years). They do much of the day-to-day work on the research programme, and are looking to gain experience to establish themselves as permanently employed researchers.

[7] Postgraduate students – researchers who are working on a Masters of Ph.D. thesis.

ENHANCING GLOBAL CONNECTEDNESS

The 05/06 funding round saw historical highs for the Fund, both in terms of the number of contracts involving international collaboration, and those involving collaboration of any kind. The proportion of the contracts involving principal and associate investigators from just a single institution has decreased from 77 % in 1995 to 38 % in 2005(see Figure A2.5).

The percentage of contracts that specifically include overseas principal or associate investigators at their onset is 46 % for the 2005/06 funding round. Further collaboration occurs during the course of the research. For projects completed in the 2005/06 year, 41 % included overseas researchers at their inception; by the time they had finished, 80 % had international collaborators.

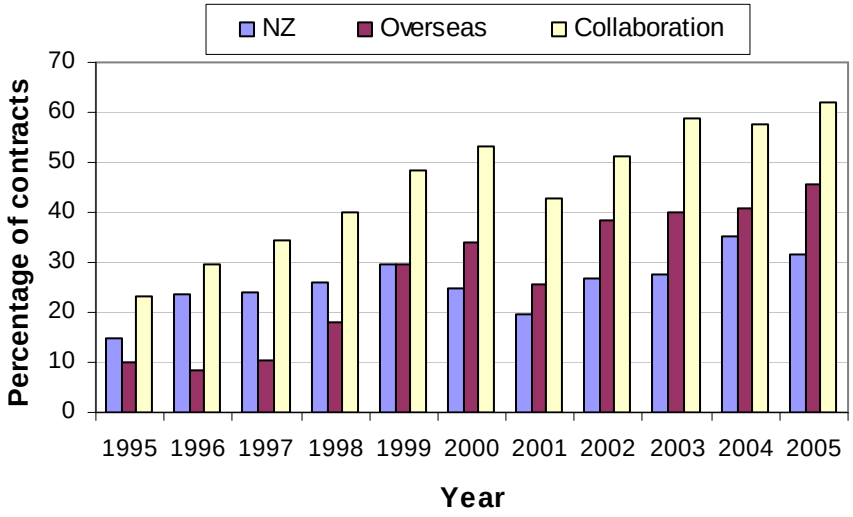


Figure A2.5. The percentage of contracts for which a principal or associate investigator is from outside the host institution, categorised according to whether the collaborator is from New Zealand or from overseas. The percentage of contracts having either type of collaboration is also shown. The year refers to the starting date of the contract.

Table 2.2. International collaboration and communication on Marsden grants.

International collaboration and communication	**'99–'00**	**'00–'01**	**'01–'02**	**'02–'03**	**'03–'04**	**'04–'05**	**'05–'06**
International collaboration – successful proposals in the year's funding round with PIs and/or AIs from overseas	30%	34%	26%	38%	40%	41%	48%
International collaboration – current contracts[8] with international collaboration (excepting proposals funded in the year's round)	73%	67%	67%	65%	66%	†	
International collaboration – contracts completed in the year with PIs and/or AIs from overseas						29%	41%
International collaboration – contracts completed in the year with international collaboration						84%	80%
International Presentations – current contracts (excluding those awarded in the year's funding round) which were presented at international conferences	67%	63%	65%	72%	78%	69%	86%

† Series discontinued

[8] Current contracts – those operating in the Government financial year indicated

BUILDING NEW ZEALAND'S KNOWLEDGE BASE

RESEARCH PRODUCTIVITY AND DISSEMINATION

Table 2.3. Publications, patents and software directly attributed to Marsden grants.*

Year of Publication	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	All Years
Papers	24	38	97	135	255	304	397	428	430	429	460	2997
Refereed Conference Proceedings		2	15	27	34	43	77	86	106	77	98	565
Book Chapters	3	2	6	11	25	27	42	53	65	66	67	367
Books			1	1	2	2	3	10	10	14	9	52
Edited Volumes					2	3	2	9	11	5	8	40
Reports		1	5	15	13	22	12	15	9	17	9	118
Patents (Full or pending)					1	3	1	3	1	2	2	13
Software					1				3	2	1	7
Total	27	43	124	189	333	404	534	604	635	612	654	4159

*either published or in press, and either wholly or partially attributed to the Marsden Fund

Table 2.4. Dissemination of Marsden results through conferences and other channels‡.

Year of Activity	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	All Years
Invited conference talk		1	15	36	44	63	96	109	125	172	204	873
Contributed conference talk		2	24	71	128	249	312	410	289	321	281	2087
Conference poster	9	8	47	116	170	155	99	88	90	115	138	1035
Other†				6	10	11	26	35	39	62	79	268
Total	9	11	86	229	352	478	533	642	543	670	710	4263

†Types of other output include: articles in non-specialist journals, gene sequences deposited in public databases, reagents developed, documentaries, radio interviews, websites, online databases, CDs distributed, and editorials and letters in specialist journals.
‡ Minimum figures, as some data from previous years continues to be collected.

BENEFITS TO NEW ZEALAND RESEARCH FROM MARSDEN-FUNDED INTERNATIONAL COLLABORATION

Using techniques, equipment or resources that are unavailable in New Zealand, often at no cost. Examples include:

Transgenic mice lacking a specific ion channel, required for research into the mechanism of action of a toxin, are being supplied by a US collaborator.
Ice core samples collected in the Antarctic are being sent to an Australian facility that will allow for the analysis of 32Si.
The structure and dynamics of anhydrous proteins are being analysed using synchrotron facilities in the USA and Europe.
A PI investigating the function of cilia in cells has made the first tomographic studies of chondrocyte primary cilia in situ, using equipment only available in a particular overseas laboratory.

Visiting overseas laboratories to learn new methods not available in New Zealand. Examples include:

- A PI investigating the neural pathways that involved in the perception of birdsong has visited a collaborator's lab in Belgium to learn a new MRI-based technique to "trace" nerve cells.
- A PI investigating the effect of mutations in mitochondrial DNA on male fertility visited the United Kingdom to learn techniques for analysing the fertilising success of sperm.

Drawing on overseas researchers' knowledge by hosting conferences, workshops and individual visits. Examples include:

- A PI studying the evolution of anciently diverged organisms hosted a researcher from the UK to initiate a new project. The UK researcher's post-doctoral fellow has also spent several months in the PI's lab working on this project.
- A PI developing a model of frazil ice formation in Antarctica has hosted his Australian-based AI, an expert in theoretical physics. This visit, along with a reciprocal visit by the PI, has greatly assisted the project by allowing rapid progress to be made on the more difficult parts of the study.
- A PI investigating how brain function is enhanced by living in an enriched environment hosted a visitor from the USA to help him establish a new technique for identifying active neurons.

Hosting young researchers and students from overseas to build links for the future. Examples include:

- A PI hosted two visiting students from Germany to carry out research on a possum parasite and to learn techniques associated with this parasite.

Leveraging Marsden funding with overseas funding. Examples include:

- An Associate Investigator on a project investigating why introduced host species frequently lose their parasite species in new environments received further research funding from the British Ecological Society for a supplementary study.

- A PI investigating the psychological impact of rape received a Fulbright award to expand the scope of the research.

Influencing overseas institutions by providing expert advice. Examples include:

- A PI involved in Antarctic research visited the National Science Foundation in the USA to provide expert advice on the influence of the sea ice in McMurdo Sound on the activities of the USA and New Zealand.
- A Fast-Start PI served on a week-long NASA Scientific Review panel, to allocate funding for projects investigating the effects of the changing Sun on the Solar System, life, and society.

RESEARCH QUALITY

The quality of Marsden-funded research is ensured by rigorous selection procedures, including national and international peer review of all proposals that proceed to the second stage of the evaluation process.

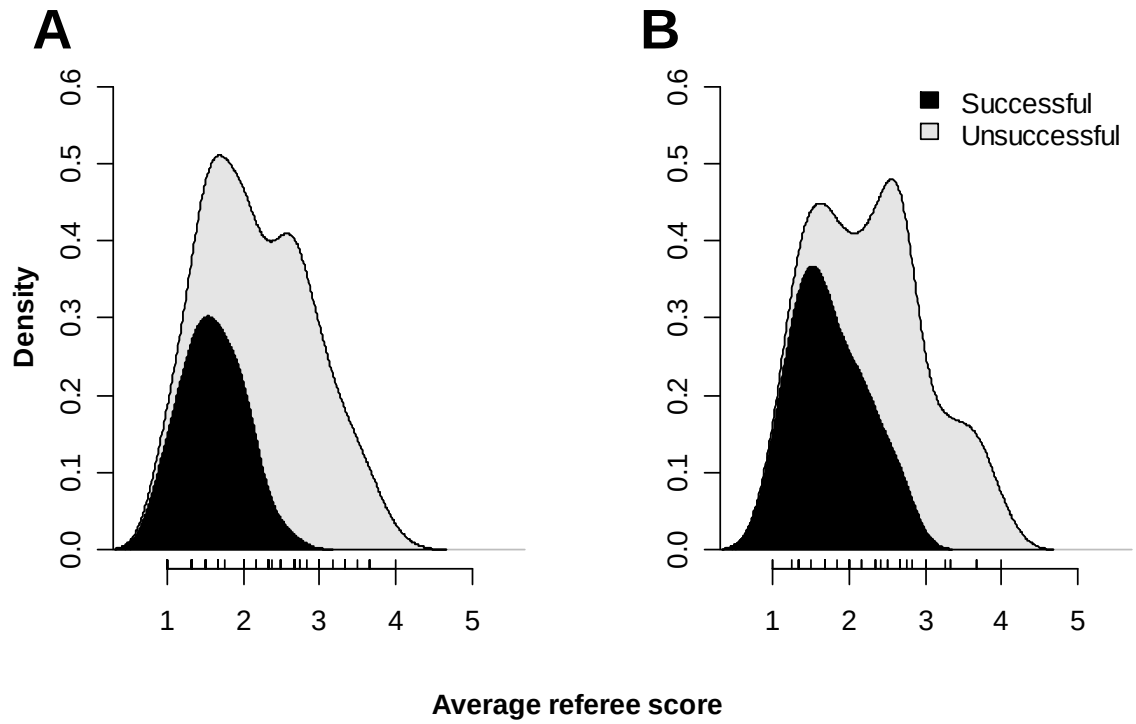


Figure A2.6. The estimated distribution of the average referee score received for both funded and unfunded proposals to the 2005 funding round[9]. Kernel density estimate with added rug plots. Panel A, standard applications, Panel B, Fast-Start applications.

Average referee scores for both standard and Fast-Start applications range between one and four, and both categories appear to have the same three populations of proposal type although in different proportions with means centred on: "Excellent" to "Outstanding"; "Well above average"–"Excellent"; and, "Above average" to "Well above average". All successful standard, and almost all Fast-Start, proposals come from the highest ranked, "Excellent" to "Outstanding", population. However, it must be noted that there are many, unsuccessful proposals that are also within this group, i.e., 35 % of proposals that reached the second stage for standard grants were successful, while an additional two-fifths were also of this extremely high calibre but could not be funded.

Measures of research excellence for contracts current in the 2005-06 year are as follows:

Papers on current Marsden contracts have been published in prestigious journals with high impact factors such as Nature, Science, the Proceedings of National Academy of Sciences, Cell, Physical Review Letters, the Journal of Neuroscience, Applied Physics Letters, the American Journal of Physiology, and the Journal of Biological Chemistry.

[9] Scores equate to: 1 = "Outstanding – among the top 5% of proposals worldwide"; 2 = "Excellent – among the top 10% of proposals worldwide"; 3 = "well above average, top 20%"; 4 = "above average"; and 5 = "average or below average".

The results from 86 % of current contracts (excluding those awarded in 2006/07) have been presented at international conferences.

Of the 7 holders of the prestigious James Cook Research Fellowships with tenure in the 2004/05 year, 4 are principal investigators on current Marsden contracts.

Numerous prizes and awards to Marsden researchers, as listed in Table 2.5.

Table 2.5: Papers of note:

- Beaulieu, J. P., D. P. Bennett, et al. (2006). "Discovery of a cool planet of 5.5 Earth masses through gravitational microlensing." Nature. 439(7075): 437-40.
- Hartley, C. J., R. D. Newcomb, et al. (2006). "Amplification of DNA from preserved specimens shows blowflies were preadapted for the rapid evolution of insecticide resistance." Proc Natl Acad Sci U S A. 103(23): 8757-62. Epub 2006 May 24.
- Jackson, R. R., X. J. Nelson, et al. (2005). "A spider that feeds indirectly on vertebrate blood by choosing female mosquitoes as prey." Proc Natl Acad Sci U S A. 102(42): 15155-60. Epub 2005 Oct 10.
- Jickells, T. D., Z. S. An, et al. (2005). "Global iron connections between desert dust, ocean biogeochemistry, and climate." Science. 308(5718): 67-71.
- Kwan, A. H., R. D. Winefield, et al. (2006). "Structural basis for rodlet assembly in fungal hydrophobins." Proc Natl Acad Sci U S A. 103(10): 3621-6. Epub 2006 Feb 28.
- Marquez, V., D. N. Wilson, et al. (2004). "Maintaining the ribosomal reading frame: the influence of the E site during translational regulation of release factor 2." Cell. 118(1): 45-55.
- Shepherd, L. D., C. D. Millar, et al. (2005). "Microevolution and mega-icebergs in the Antarctic." Proc Natl Acad Sci U S A. 102(46): 16717-22. Epub 2005 Nov 7.
- Wang, P. Y., K. Koishi, et al. (2005). "Mullerian inhibiting substance acts as a motor neuron survival factor in vitro." Proc Natl Acad Sci U S A. 102(45): 16421-5. Epub 2005 Oct 31.

Table 2.6. Awards and prizes- for contracts reviewed in 2005/06

Marsden researcher	Contract(s), role	Distinction awarded
Dr Brian Easton	PVT301 PI	Fulbright Distinguished Scholar 2004
Dr Jennifer Hay	UOC209 PI	University of Canterbury Teaching Award
Prof David Lambert	MAU104 PI MAU302 PI MAU0402 PI	Massey University Team Research Medal 2004
Mr Tet Woo Lee	UOA211 student	FRST Bright Futures Top Achiever Ph.D. Scholarship
Dr Karen Speedy	UOA013 student	Lectureship at Macquarie University and has Australian Arts council funding to continue research
Prof Gary Housley	UOA305 PI	Elected to Editorial board - Purinergic Signalling
Prof Gary Housley	UOA305 PI	Elected Associate Editor - Journal of the Association of Research in Otolaryngology
Prof Gary Housley	UOA305 PI	James Cook Fellowship, RSNZ
Prof Andrew Abell	UOC205	Erskine fellowship
Dr Tadashi Fukami	LCR202 PDF	Japanese Ecological Society award for excellence
Dr Mike Berridge	MIM102 PI	James Cook Fellow
Patries Herst	MIM102	Richard Stewart Memorial Prize for Young Scientists (co-winner) NZ Society for Oncology Pfizer Oncology Award
Dr Greg Funk	UOA905 PI	Elected to editorial board of Respiration Physiology and Neurobiology (2001)
Dr Greg Funk	UOA905 PI	Physiological Society of New Zealand's Triennial Gold

		Medal for outstanding contributions to physiological research (2002)
Mr Angus McMorland	UOA905 student	Physiological Society of New Zealand's Mary Bullivant Prize for best student presentation (2003)
Dr Deborah Young	UOA102	Invitrogen award - $10 000 toward travel and products
Ms Joelle Gergis	UOA108 student	Joint UN Climate Research Program, NSF travel award (2004)
Ms Joelle Gergis	UOA108 student	Highly commended student poster, PAGES open science meeting (2005)
Prof David Kelly	UOC103	RSNZ Cockayne Memorial lecturer (2004)
Dr Roger Dungan	UOC103 PDF	Joint winner, environmental sciences category, MacDiarmid Young Scientist of the Year (2005)
Dr Katja Riedel	NIW201 PI	Honourable mention for paper presentation at the International Young Scientists' Global Change Conference, Trieste, Italy (2003).
Prof Robert McLachlan	MAU202	Massey University Research Award and Outstanding Individual Researcher, 2005
Dr Justin O'Sullivan	MAU0401	Massey University Research Award, 2005
Dr Steve Marsland	MAU0408	Massey University Research Award, 2005
Dr Mark Waterland	MAU211	Massey University Research Award, 2005
Professor Ian Witten	UOW608, UOW901	2005 Hector Medal, The Royal Society of New Zealand
Dr Johanna Montgomery	UOA0512	Eppendorf and Science Prize for Neurobiology, for neuroscientists that have received their Ph.D. in the last 10 years (first ever Southern hemisphere winner)
Dr Barbara Holland	MAU0509	2005 Hamilton Memorial Prize, Royal Society of New Zealand
Dr John Reynolds	UOO108 AI UOO302 AI UOO0410 PI UOO0513 PI	Brain Research Young Investigators Award (2004)
Dr Jeff Wickens	UOO108 PI	Personal chair in Anatomy and Structural Biology (2004)
Dr Jeff Wickens	UOO108 PI	Elected fellow of Institute of Physics
Associate Professor Robert F Anderson	UOA0407 PI	Elected fellow of the New Zealand Institute of Chemistry
Associate Professor Carol M Taylor	UOA617 PI MAU007 PI MAU312	Elected fellow of the New Zealand Institute of Chemistry
Associate Professor Henrik E.G. Kjaergaard	UOO816 AI UOO917 PI UOO0405 PI	Elected fellow of the New Zealand Institute of Chemistry
Professor Margaret Brimble	UOA803 PI UOA118 PI UOA0508	HortResearch Prize for contribution to Chemical Science 2005 (NZ Institute of Chemistry)
Professor Paul Callaghan	MAU704 PI HRT805 AI UOO911 AI MAU006/VUW005 PI VUW310 PI	The Rutherford Medal 2005 (RSNZ)
Professor Richard Faull	UOA208 AI	The Liley Medal 2005 (Health Research Council of New Zealand)
Dr Jim Renwick	NIW0501 PI	Edward Kidson Medal 2005 (Meteorological Society of New Zealand)
Dr Fiona McDonald	VUW903/UOO919	Research Medal (for outstanding research by a young scientist) 2005 (New Zealand Association of Scientists)
Professor Robert McLachlan	MAU609 PI MAU202 PI	NZ Mathematical Society Research Award
Professor James Sneyd	AGR501 AI MAU009/UOA022 PI UOA0421 PI	NZ Mathematical Society Research Award
Dr Julian Eaton-Rye	UOO521 PI UOO805 AI	Outstanding Physiologist 2005 (New Zealand Society of Plant Physiologists)

	UOO309 PI	
Professor Barry Scott	MAU510 PI MAU010 PI MAU103 PI MAU0403 PI	Applied Biosystems Award (New Zealand Society for Biochemistry and Molecular Biology)
Professor Jacob Bercovitch	UOC308 PI	Elected as Fellow of the Royal Society of New Zealand, 2005
Professor Graham Le Gros	MIM802 PI	Elected as Fellow of the Royal Society of New Zealand, 2005
Professor Bakhadyr Khoussainov	UOA017 PI UOA319 PI	Elected as Fellow of the Royal Society of New Zealand, 2005
Professor Neil Pearce	MAU308 AI	Elected as Fellow of the Royal Society of New Zealand, 2005
Professor James Sneyd	AGR501 AI MAU009/UOA022 PI UOA0421 PI	Elected as Fellow of the Royal Society of New Zealand, 2005
Dr John Reynolds	UOO108 AI UOO302 AI UOO0410 PI UOO0513 PI	Otago University Early Career Award for distinction in research
Professor Warren Tate	UOO210 PI	University of Otago School of Medical Sciences Award 2005 (for the School's top scientific paper, published in Cell)
Professor Jack Baggeley	UOC911 PI	University of Canterbury Research Medal, 2005
Dr Brian Easton	PVT301 PI	Distinguished fellow of the New Zealand Association of Economists
Dr Brian Easton	PVT301 PI	Adjunct Professor, Institute of Public Policy, Auckland University of Technology
Assoc Prof James Shulmeister	UOC301 PI	Hockstetter Lecturer of the Geological Society of New Zealand (2005)
Assoc Prof James Shulmeister	UOC301 PI	Visiting fellowship, Research School of Pacific and Asian Studies, Australian National University (2005)
Phil Burge	UOC301 student	Wellman Research Award of the Geological Society of New Zealand (2003)
Mr Henrik Rother	UOC301 student	Highly commended student paper at Australasian Quaternary Association Conference (2004)
Mr Craig Woodward	UOC301 student	Highly commended student paper at Australasian Quaternary Association Conference (2004)
Dr Nicola Gavey	UOA006 PI	Fulbright New Century Scholar (2004-2005)
Dr Johan Lauwereyns	VUW0406 PI	Merit Award for Excellence in Research, VUW (2004)
Dr Johan Lauwereyns	VUW0406 PI	New Researcher's Achievement Award, VUW (2004)
David Haines	UOO316 student	Best Student Essay (joint winner), New Zealand History Association (2005)
Assoc Prof Emily Parker	MAU008 PI	New Zealand Institute of Chemistry (NZIC) Easterfield Medal 2005
Professor Paul Callaghan	MAU704 PI HRT805 AI UOO911 AI MAU006/VUW005 PI VUW310 PI	Principal Companion of the New Zealand Order of Merit: For services to science.
Professor Atholl Anderson	LCR0402 PI UOW0502 AI	Companion of the New Zealand Order of Merit: For services to anthropology and archaeology.
Professor David Penny		Companion of the New Zealand Order of Merit: For services to science.
Associate Professor Dave Grattan	UOO009 PI UOO202 PI UOO301 AI	Triennial Medal (Physiological Society of New Zealand)
Rachel Augustine	UOO202 Ph.D. student	New Zealand Society of Endocrinology Student Speaker Award
Professor Barry Scott	MAU0403 PI MAU103 PI MAU010 PI	Applied Biosystems/NZBMB award for excellence in research (2005)

Professor Peter Steel	UOC908 PI UOC311 PI	James Cook Fellowship (RSNZ) 2005
Professor Wei Gao	UOA119 PI UOA0411 PI	James Cook Fellowship (RSNZ) 2005
Professor Atholl Anderson	LCR0402 PI	Companion of the New Zealand Order of Merit (CNZM) (2005)
Mr Adam Norrie	PVT202 Ph.D. student	Hatherton Award (RSNZ) 2005
Mr Jack Lee	UOA0410 Ph.D. student	Best Engineering Science poster at a University of Auckland competition.
Prof Ray Harlow	UOC309 PI	Appointment as Chair of Linguistics at the University of Waikato
Dr Catherine Day		University of Otago's Rowheath Trust Award and Carl Smith Medal for 2005.
Assoc Prof David Raubenheimer	UOA0404 PI	Research Associate for the National Research Centre for Growth and Development, CoRE (2005).
Assoc Prof David Raubenheimer	UOA0404 PI	Membership to the Plant Animal Interaction Network, Sydney, Australia (2005)
Dr Kendall Clements	UOA0404 PI	Membership to the Plant Animal Interaction Network, Sydney, Australia (2005)
Prof Howard Choat	UOA0404 AI	Bleeker Award in Ecology (2005)
Prof Kathryn Crosier	UOA209 PI	Officer of the New Zealand Order of Merit (ONZM), (2005)
Prof Colin Wilson	GNS202	Elected fellow of American Geophysical Union
Dr Susan McCoard	AGR303	NZBio Emerging Biotechnologist 2005
Dr Rebecca Campbell	Postdoc on UOO204	Endocrine Society (USA) Endocrinology Student Award 2005
Dr Lesley Collins	Postdoc on MAU303	Fitch Prize (Society for Molecular Biology and Evolution) for best student / post-doc paper; believed to be the first New Zealander to win this
Dr Justin O'Sullivan	MAU0401	Awarded Massey University Early Career Research Medal

APPENDIX 3 - JAMES COOK RESEARCH FELLOWSHIPS

During 2005/06 there were eight active Fellowships:

- Professor Ian Pool (Research of relevance to New Zealand and/or the South West Pacific): A demographic history of New Zealand—completion date 03/2006.
- Professor Margaret Brimble (Physical Sciences): Synthesis of shellfish toxins as novel chemotherapeutic agents—completion date 06/2006.
- Associate Professor Andrew Pullan (Engineering Sciences and Technologies): Detailled computer modelling of gastrointestinal bioelectric activity—one year extension granted—completion date 06/2006;
- Professor Colleen Ward (Social Sciences): Acculturation, adaptation and intercultural relations—completion date 03/2007
- Professor Robert Jackson (Biological Sciences): Predators that target human disease vectors—completion date 03/2007
- Associate Professor Gary Housley (Health Sciences): Auditory function—sound transduction and neurotransmission—completion date 06/2007
- Professor Peter Steel (Physical sciences): New metallosupramolecular building blocks—completion date 03/2008
- Professor Wei Gao (Engineering Sciences and Technologies): Nanostructured porous oxide films and their applications—completion date 03/2008

APPENDIX 4 – INTERNATIONAL

Figure A4.1. Number and value of grants awarded:

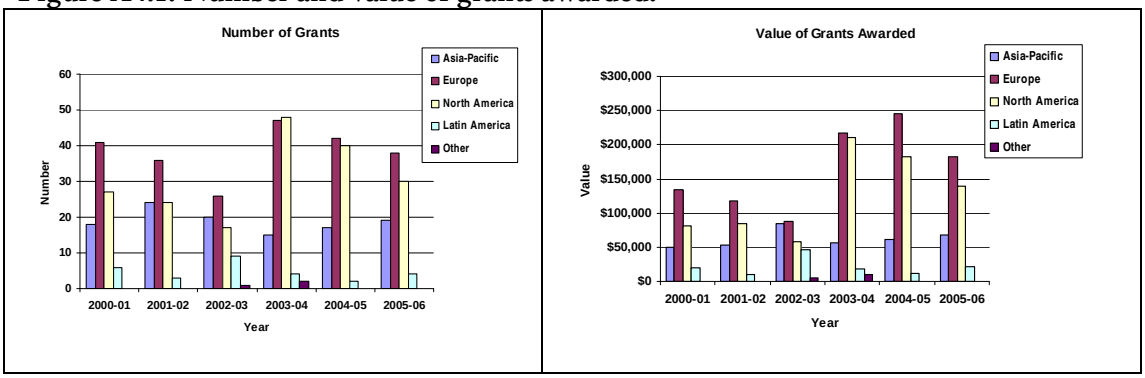


Figure A4.2. Institutional distribution of grants awarded:

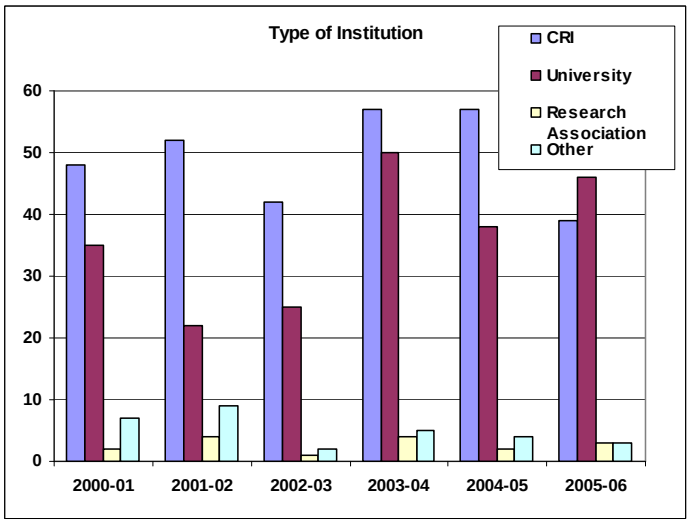


Figure A4.3. Outcomes from the awards:

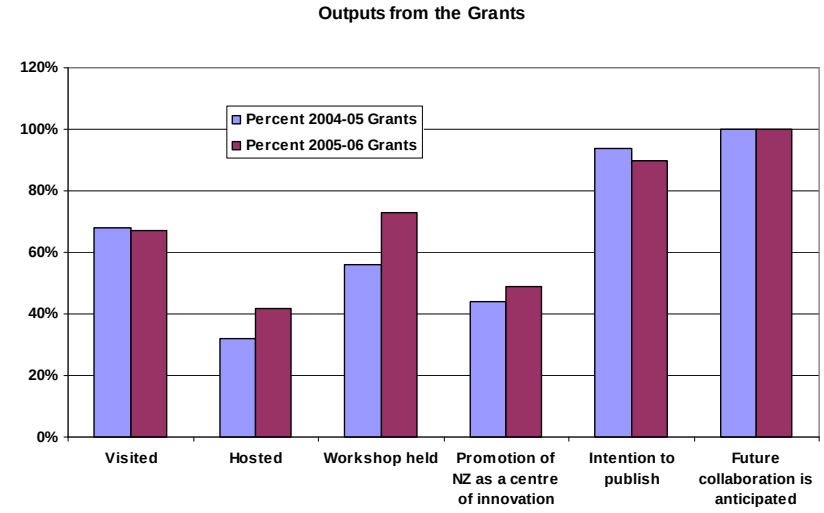
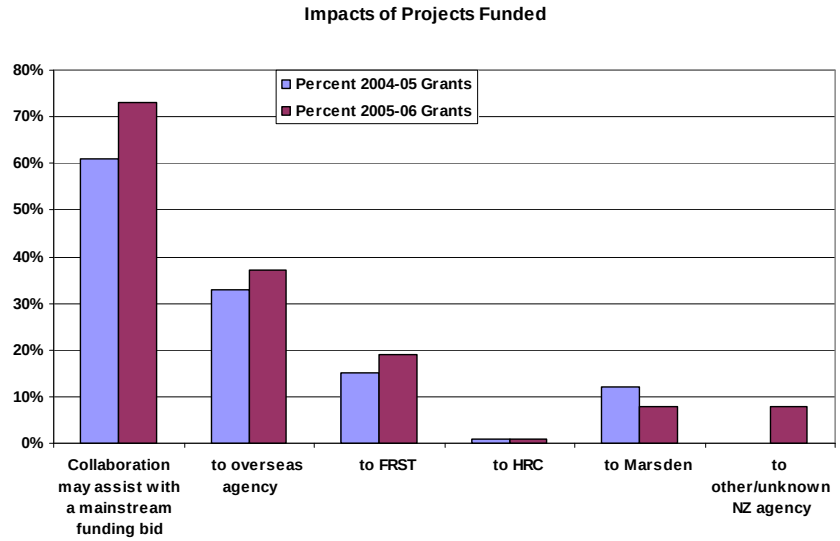


Figure A4.4. Impacts of the awards:



APPENDIX 5 - JOURNAL STATISTICS 2006

JOURNAL IMPACT, RANKINGS AND INPUTS

Figure A5.1. Journal Impact factors:

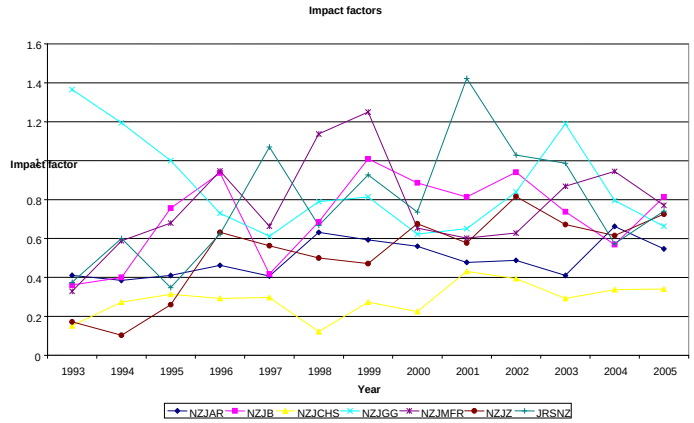


Figure A5.2. Journal Rankings:

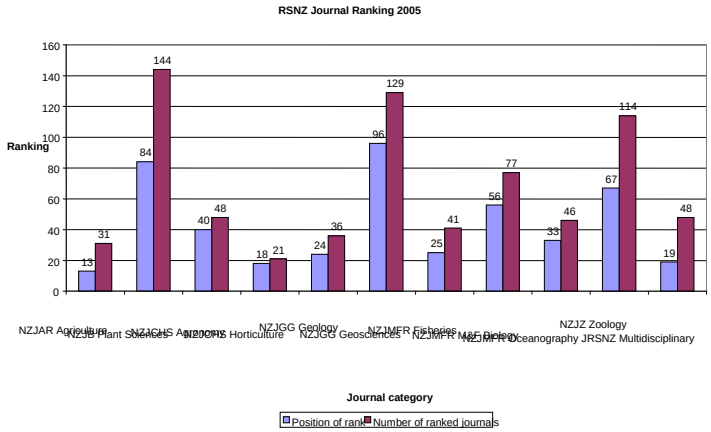
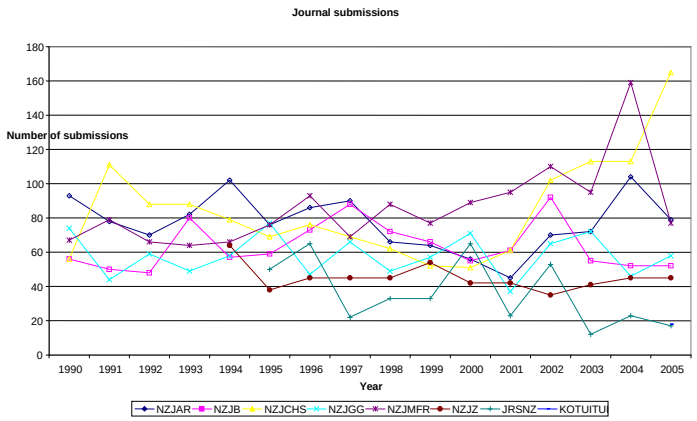


Figure A5.3. Submissions:



SUBSCRIPTIONS:

Figure A5.4. Subscriptions by journal

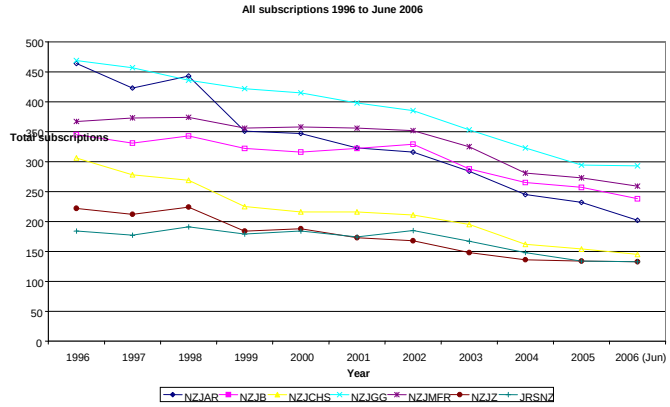


Figure A5.5. Sales by country 1996-2005

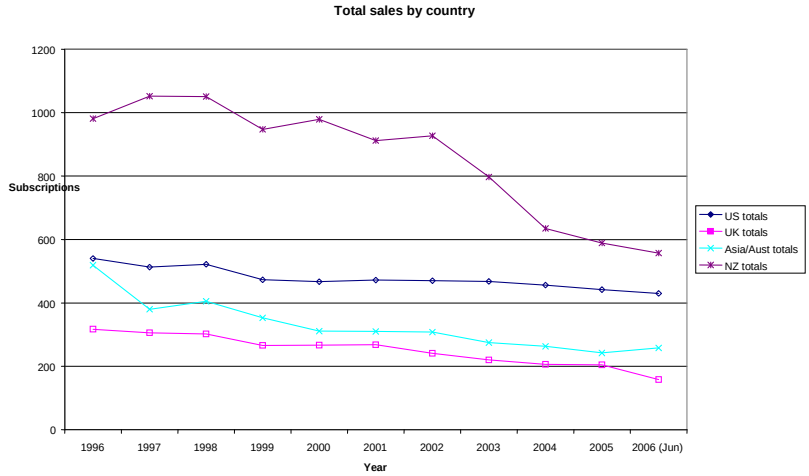


Figure A5.6. Total sales:

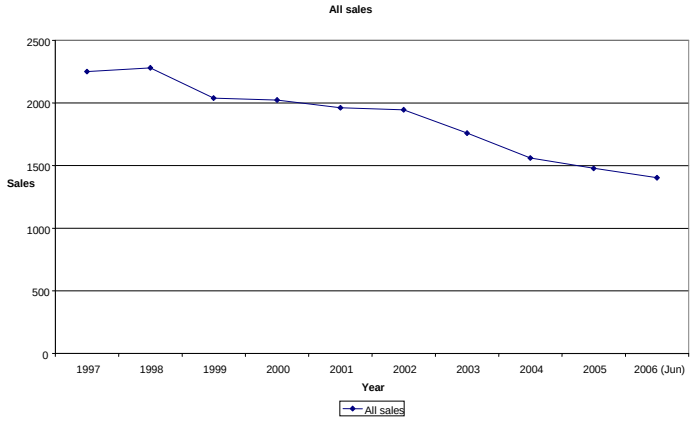


Figure A5.7. Journal Web Access:

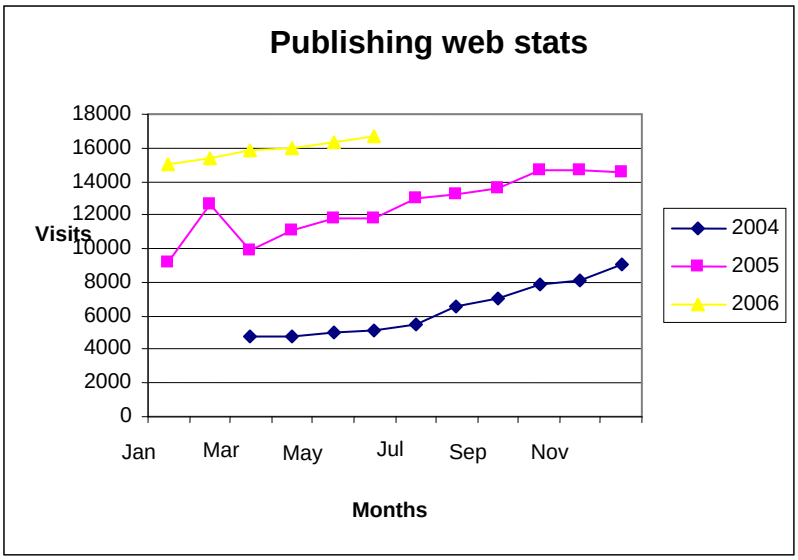
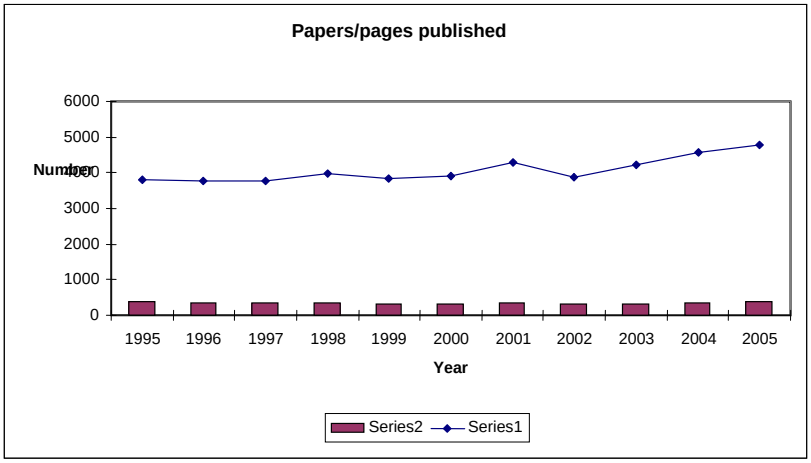


Figure A5.8. Journal Outputs:



APPENDIX 6 – INTERNATIONAL COMMITTEE MEMBERS

- Professor David Parry FRSNZ, Massey University, Vice President, International Council for Science (ICSU);
- Professor Ian Pool FRSNZ, University of Waikato Expert Panel - Priority Area Assessment on Capacity Building in Science of the International Council for Science (ICSU);
- Dr Clive Howard-Williams FRSNZ, NIWA, Vice President, Scientific Committee on Antarctic Research (SCAR);
- Mr Peter Spratt, Royal Society of NZ, President-elect, International Council of Associations for Science Education (ICASE).
- Dr Steve Thompson MRSNZ, Royal Society of NZ is chair of the International Council for Science (ICSU) Working Group on a new dues structure.