2001 Progress & Achievements Report

It is a requirement of the 2001-02 Output Agreement between the Minister of Research, Science & Technology and the Society that the Society provides, by 31 October, a Progress and Achievement Report of the outputs that are funded by the Minister and managed by the Society.

The report is attached for your information but it must remain confidential to Council as the Minister is yet to provide his commentary on it to the Society.

The ROYAL SOCIETY of NEW ZEALAND

PROGRESS & ACHIEVEMENT REPORT

October 2001

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INTRODUCTION

The Royal Society welcomes the change to reporting by output classes, within which target outcomes and impact expectations are implicitly, rather than explicitly, considered. This has facilitated more coherence in the reporting.

The Royal Society's focus is on Advancing and Promoting Science and Technology, as laid down in our Act. We promote, invest in, and celebrate excellence in people and ideas in S&T and put them to work as an example and inspiration to New Zealanders. Many of our aims are shared with MoRST and the Government, where there is considerable synergy in our work.

As the 'people place' we focus on the human aspects of the field, where we have major thrusts underway to develop New Zealand's capacities and standards of excellence in the sciences and technology. One aspect of this is a major new project to assess New Zealand's supply and demand of S&T human resources.

The Royal Society's Manifesto for Science, Technology and Innovation stated: 'Human capital issues are arguably the most severe constraints prohibiting achievement of a knowledge society'. The broad parameters to be addressed in any human capital strategy include:

- Education and training – not just in terms of volume but also matching supply with demand for a skilled workforce of scientists, technologists, technicians and support staffs.
- Attracting sufficient students and apprentices into developing areas of science and technology.
- Recruiting a skilled workforce from those recently trained in New Zealand and by migration.
- Retaining a skilled workforce, both New Zealand-trained and immigrant.
- Reversing the negative factors affecting training, recruitment, retention and attraction back to New Zealand, including short duration of contracts, student debt, lack of early career support, and low pay

We will be progressing the Human Resources Project that is currently at sponsorship stage. Many parts of Government are faced with the need to make strategic decisions on behalf of New Zealand that require key information about the likely future needs for properly resourced, skilled practitioners in all areas of RS&T to carry out the work that will be the basis for our future prosperity and safety. All agree that these human resources will not automatically be where they are needed, when they are needed. There is much work to be done to provide decision makers in such areas as economic development, labour, immigration, education and resource management, as well as RS&T, with the information they will need in time to enable them to make good future decisions. This project will deliver high quality information, for the benefit of New Zealand.

We are very aware that the value to the country of science and technology comes when the providers of high quality scientific work are in contact with possible end users in a way that informs both parties. Each group has its own responsibilities, but each is enriched and challenged by understanding the other. The Royal Society is very active in building closer links with industry, with the aim of encouraging each to think more widely – to see entrepreneurial possibilities where there were none and to develop channels for putting these to work. We will continue to work with the many groups we have ties with, both inside and outside of the Society. We will continue to generate ideas and bring them forward for discussion and action. We will

continue to build links with organisations such as MoRST and MED, and to promote initiatives such as the Royal Society's Technology Advisory Group, chaired by Sir Ron Carter and the National Network of Technological Societies with IPENZ. We will continue to encourage the development of a Knowledge Industries Council.

RS&T is seriously under resourced in New Zealand. It is generally accepted that New Zealand's future prosperity will come from the sensible use of science and technology, yet the Marsden Fund, which has grown considerably from small beginnings in 1995, and is hugely productive in terms of outcomes that are useful to New Zealand, is currently able to fund only 10% of applications, compared to a level of funding by international equivalents of 30 – 40%. Much is made of the need for New Zealand to have strong links with the rest of the world and the level of funding for international activity needs to be adjusted for recent changes in the exchange rate; currently only about $NZ30,000 is left to support scientists and technologists international contacts and collaboration after necessary subscriptions have been paid.

The dissemination of information is critical, both inside the scientific community and in the wider society, and New Zealand's scientific journals form a national strategic asset. However resources for scientific journal publication have remained static over a decade while output has increased dramatically. The Society is currently reviewing ways to redress this imbalance. We are seeing how a concerned but uninformed public reacts to scientific developments in the GE debate, yet little is known about how New Zealanders wish to be informed, and there is less money to do anything about it.

The Human Resource Study discussed above is urgently needed to enable us to begin to address issues that have been developing for many years. It takes about 20 years and concentrated resources to train a scientist and bring them to a high level of expertise, to where they can deliver the creativity and innovation New Zealand desperately needs. We have an ageing population of scientists and technologists, and many are finding greater opportunity overseas – taking a huge investment with them.

The Royal Society welcomes discussion on any of these points and is more than willing to play an active part in the development of a New Zealand we can all be proud of.

POLICY IMPLICATIONS AND FUTURE INVESTMENT PRIORITIES

Marsden Fund

The low success rate of applications is the key criticism of the Marsden Fund. The success rate of 9.7% for the 2000/01 round compares poorly with international rates of, for example, 40% for the Engineering and Physical Sciences Research Council in the United Kingdom. Nonetheless, the Fund has enjoyed increases of $3m and $2m, respectively, in the last two budgets, increases that have made a significant difference to the number of researchers and research programmes that can be funded. However, the Marsden Fund is still unable to fund many excellent applications. For this reason, the Royal Society considers it important that the Marsden Fund continues to grow. Growth of the Fund would be welcomed also by the research community.

Two aspects of New Zealand science which should be reviewed are the availability of postgraduate students and mechanisms for purchasing new equipment. Anecdotal evidence strongly indicates that New Zealand is unable to fill all the postgraduate positions that are available in its science programmes. There is a need to ascertain if this is the case and, if so, why is it happening, how will it affect the future work force, and what corrective policies are required. There are also complaints about the inability to fund new equipment.

James Cook Research Fellowships

The objective of encouraging sustained excellence within the particular disciplines covered by the Fellowships ties in well with the objectives of the Society's Academy Council and the Marsden Fund. Since those awarded the Fellowships are very talented people, one of the criteria of the Fellowship, we believe, should be for the Fellowships to act as role models for school students and undergraduates and go out and speak to them, and act as mentors.

At present the Fellowship criteria say that the Fellowships will be awarded to senior researchers who are recognised leaders in their respective fields. It is the Society's opinion that the Fellowships would be better targeted to researchers in mid career rather than those on the verge of retirement as has been the case with some recipients. This would better meet the objective of "Supporting Promising Individuals" who can have further input into the innovation system during the later part of their careers.

Most Fellows undertake their Fellowships within New Zealand but may take trips overseas to collaborate for short periods of time.

The increasing numbers of recent Fellowships who have opted to remain in New Zealand for all or most of their Fellowship reflects the fact that although the emolument (currently $90k pa, plus agreed expenses) is sufficient to maintain a Fellowship in New Zealand, it does not cover the escalating cost of working in an overseas university or institution. If the benefits of this Fellowship are to be maximised it is vital that future fellows are encouraged to travel overseas, by the provision of realistic local cost-of-living adjustments taking into account the varying fortunes of the New Zealand dollar, or the payment of the fellowship in the local currency, again adjusted for currency fluctuations. If increased funding cannot be secured, such a policy would result in the available funding supporting fewer Fellowships but the quality of the outcomes and the related benefits to both the fellows and to New Zealand would be enhanced. A lower level of stipend with the appropriate cost-of-living allowance might be an alternative to consider.

The Royal Society's Academy Council also considers the level of funding of these prestigious Fellowships to be inadequate.

Science, Mathematics and Technology Teacher Fellowships

Now that the fund is of a significant size and can now support a critical mass in terms of a significant impact, the Royal Society is taking a more active role in the management of individual fellowships and their ongoing activities in order to maximize the returns from the programme. We must ensure that teachers pass on their enthusiasms and learning, as it is very easy for a Teacher Fellow to return to the classroom and become engulfed again in the demands of their teaching and school programmes. We will also provide more direction during the fellowship year by supplying selected materials on science and technology and education in these fields for teacher fellow consideration and discussion as well as ensuring all become ICT literate during their fellowships.

The $2.1 million increase to the Science, Mathematics and Teacher Fellowships in 1999 was for a fixed term (two-thirds of the total Fund). The implications of this need to be discussed.

International Science And Technology (ISAT) Linkages Fund

Many of the recipients advise that they are much better placed to seek mainstream funding for ongoing research after the initial collaboration has been completed and in many cases, there is significant long-term benefits to New Zealand resulting from the collaboration with internationally recognised experts such as a better understanding of new techniques and innovations as well as the use of "state-of-the-art" equipment which is unavailable in New Zealand. In addition, a number of the collaborations have resulted in the intent to publish the results of the research.

Over the past four years the size of the four programmes administered by the Society have remained static at $245,000 (GST inclusive) although an additional $40,000 was provided by the Ministry for the 2000/01 year ($20,000 in 1998/99 and $80,000 in 1999/2000).

It is strongly recommended that the fund be permanently increased to a baseline figure of at least $350,000.

Management of the Science & Technology Promotion Programme

Auckland Festival

It was intended that the Festival, as funded by Vote RS&T and the Society would be a once only activity, to show what could be achieved by all interested parties working together. This was clearly demonstrated. The task now is to develop a model, in consultation with Auckland players, for them to take up the challenge and move forward. This the Royal Society intends to do.

There have been requests for similar initiatives to be held in other centres. The report prepared by the organisers contains a lot of very useful information to assist any further local effort.

There is a place for large-scale 'umbrella' events, they reach a lot of people in a short time, and the leveraging possibilities are strong. For example, visiting 'acts' can be used by more than one event, thus spreading the cost. They need to be kept in perspective, as it would be easy to end up putting all available money into such events, but it would be a shame if the possibility was excluded.

Science Communicators Network
A network is established and will shortly be holding its annual meeting. We expect a larger turnout than previous years. The success of this network is crucial to the effectiveness of S&T promotion in New Zealand as the resources available need to be used in the most efficient manner. This year we will be addressing the issues of co-operation explicitly as part of the two day programme.

Role Models Programme
A fundamental shift in how people view science and technology needs to occur before there will be any major changes in the types of decisions that society must discuss and reach conclusions on. S&T needs to be repositioned to show the creativity and imagination inherent in science and technology. For this to occur, the science community needs to be brought closer to the wider community. The Society's Role Models programme is very effective in this respect, identifying enthusiastic people and providing a platform for them to speak to general audiences. In this way, the wider community are starting to put a 'face' to science rather than having it as a well-intentioned concept. We are keen to continue development of this, and to increase the emphasis on creating opportunities for dialogue, as well as the more passive presentations.

We have begun to work closely with other champions of S&T to take the role models programme out to the community in a number of different ways. Giving scientists an audience for a talk followed by questions is still a good way for people to get a rapid, broad, accurate overview of a topic which they are interested in. If the speaker is good and the presentation is of a good standard for the audience it can be a very satisfactory experience all round.

We are keen to broaden that approach to include even more dialogue, and to add to the portfolio some explicit guidance in community interaction. Branches of the Royal Society, and other groups are willing to take up the challenge, and staff of the Society are ready to work with them.

We see the future of the Programme as a continuation of the loop that is being established, involving this and other promotion areas – where there is research to establish levels of knowledge/concern, potential tools to help progress issues are developed/piloted, tools are given to the informed groups who wish to be involved in dialogue around the issue and then any changes (or not) in levels of knowledge/concern are measured.

Wow! its science website
We have begun a full review of this initiative and expect to discuss this with you over the next few months. The site could have a much greater impact than it currently does. The options under consideration are the cessation of the site, continuation as is, or major intervention to broaden its coverage to include all areas of science and technology. Under any plan for continuation a marketing plan will have to be prepared to raise the profile and usage of a site containing excellent material. The Society will investigate funding options if the site was to continue; there could well be leverage with a number of current Royal Society activities, both within the Purchase Agreement and others funded by sponsorship, to support such a redevelopment.

Promotion of Science & Technology
Application forms will be reviewed this year, in order to make them easier to fill out, more specific, and easier for the Advisory Group to read. Applicants will be required to submit sample budgets along with their applications.

Our 2001/02 pilot project of targeting businesses and Maori produced applications from organisations who would not normally have applied to this fund. Regular applicants also realigned their objectives to fit in with these targets. Applications were selected on the basis of merit, however the increased number of applications in these areas was reflected in the successful recipients, with Maori initiatives receiving over 20% of funds, and over 13% for business outreach.

A number of applications were received that were ineligible for funding, according to the terms of reference as set out in the Purchase Agreement. Several applications were for continuing projects, and others were designed to mentor high-achieving students already involved in science and technology, which did not meet the criteria of impacting on non-attentive audiences. This year, the Auckland Branch of the RSNZ (Auckland Museum Institute) was granted funding for a project. The Decision Panel, in consultation with the Chief Executive and Executive of the Council of the Royal Society of NZ, concluded that the RSNZ Branches are financially independent organisations and are therefore eligible for funding from the Science and Technology Promotion Fund.

The Promotion Fund Decision Panel raised several points from this year's round of applications.

- They are looking out for new ideas and innovative ways of science promotion. Many applications in this year's funding round were for websites and CD Roms, which are becoming passé.
- The group were also actively looking for applications that reposition science as creative and imaginative.
- There was a disappointing lack of applications from some regions, including the West Coast, Taranaki and Northland. They will be targeted for additional promotion of the Fund in the 2002/03 round.
- Next year's round should include an indicative budget as part of the application.

Presently, applications close in July, with the funding available to June 30 the following year. After the selection process, this time is shortened to 8-9 months (from October- June). Extensions are often requested to complete the projects. An adjustment for close of applications to May each year would ensure that all contracts may be completed in the allowed time. It is noted on the application form that the funding is dependent on the Budget allocation each year.

This Fund is designed to provide money to initiate new projects. Many of these projects have had the potential to expand into national outreach initiatives with more or less guaranteed impact. However, funding for this second phase of promotion is not readily available and the opportunity is lost. To ensure these opportunities are realised, a broadened Science and Technology Promotion Fund, with its contestable format, would provide an excellent way to develop and nurture a sophisticated portfolio of innovative science and technology promotion initiatives. Successful pilot projects could apply for money to expand their programmes. Major promotion themes will emerge over time through merit, with new initiatives also nurtured each year. In this way, science and technology promotion will respond to the overlapping and changing needs of New Zealand society.

There are two strategic options for this output:

a) The Fund becomes more focused, targeting selected topics for an output-based funding regime. These foci would require 2-5 year funding rounds for effective results. This option

would be less responsive to the changing requirements of New Zealanders and would discourage applicants from trying new ideas.

b) The Fund has excellent potential to be advertised more widely, attracting a larger number of, and a more diverse range of applicants. However, we already receive applications for more than $2.5m for a pool of $400k. An increase in the pool of contestable funding would be necessary for this expansion to be successful.

We recommend a mixture of the above. We would like to see the innovative and risk-taking component retained, as that is important to keep the activities fresh and to keep the focus on non-attentive audiences. It is also important that the fund does not become a routine part of an organisation's funding, where it could become lost in the general pool.

There is a need to have funding guaranteed for longer than two years in some cases, although for many two years is enough. We suggest that the panel should be given discretion to extend the funding period to a maximum of four years if they felt sufficient benefit would be gained. Alternatively, organisations may re-apply each year for continuing funding, up to a maximum of four years.

We see this programme as a leader in the way we expect the promotion area to develop. We would like to see additional funding, enabling us to keep a flexible, proactive leadership role, which, when backed up by continued research, will enable money to be spent in a creative and effective manner.

Science and Technology Publications

A strategic plan for the Publishing Unit is presently being developed. Of particular interest is the question of electronic publishing of the journals. International trends for science journals show that normal subscriptions are under threat due to the effects of rising subscription rates of many commercial journals combined with the effects of increased e-publishing, which has unique user benefits such as speed of publication, interactive referencing, and access to a greater range of material. Our journals have been similarly affected over the years, though current figures indicate that subscriptions for 2001 have not fallen from those of 2000. This suggests that overseas library cancellations may have stabilized for now. However, the growth of electronic publishing, leading to library conglomerate subscriptions both here and abroad, is considered to be a major reason why many overseas libraries are reluctant to subscribe to regional or marginally relevant journals, so our journals must still be considered to be at risk of further cancellations. This is a catalyst for us to begin electronic publishing in the near future. We are examining now the technical infrastructure required and the best commercial model to employ to meet the needs of the journals and their users most efficiently and effectively.

The allocation made in publishing and distributing scientific knowledge by Vote RS&T has not changed in a decade. This means that there has been a substantial reduction in investment, in a time when output has increased by about a third.

Immediate needs for electronic publishing will be an increase in resource to cope with an increased file conversion (thus making older material available) as well as a much greater level of document management on the web. This will involve a major increase in hardware and software capability.

An added benefit, once the improved systems are in place, will be the ability to create 'virtual' journals on subjects that are either wider, more topical, or both. These would be put together

and made available on the web alone, they would not be printed and bound. Overseas experience shows that such journals do not erode the present subscription base, but are a new source of both readers and income for a moderate cost.

Effects of e-journals on the S&T community

Electronic journal publishing will benefit New Zealand science by improving the times to publication. The initial speed of processing papers through to publication will be increased through increased use of the internet for the transmission of draft papers to referees and authors. The handling and assessment of individual papers will become faster and more efficient, and eventual publication times will be shortened. Thus, major scientific knowledge will become available to researchers in a shorter timeframe, as papers can be published earlier than if they were to be scheduled for print publication alone.

Potentially greater benefit is to be gained by the research becoming immediately available to a far wider readership than the print journals now allow. Having a journal presence on the internet means that all papers become searchable and available for interested researchers throughout the world. Papers will be accessed and read by scientists with no prior knowledge of the journal itself, using specific search capabilities. Thus, the information will be disseminated more widely and faster than is currently possible, which represents a significant increase in value of the initial investment.

Royal Society International Memberships and Related Activities

As the main funder of research the Government has a substantial responsibility for international collaboration. Furthermore, international collaboration and participation is necessary to discharge global responsibilities (eg climate, biodiversity etc).

There are costs associated with international collaboration over and above the costs of research. Effective collaboration needs travel and time to be spent on exploring opportunities etc and with the New Zealand dollar being weak and the country physically being in a remote position in contrast to Europe and USA, an increase in funding is more than warranted. At present the Society receives $150,000 (GST inclusive) in Government funding for New Zealand's international memberships and related activities and after the international union membership subscriptions and GST requirements have been met approximately $27,000 remains to support NZ delegates wishing to attend their respective international congresses, general assemblies etc as well as supporting international visitors to New Zealand such as Professor Alan MacDiarmid, and the provision of seed funding to attract international conferences/fora to New Zealand.

In addition, the Scientific Committee on Antarctic Research (SCAR) is by far the largest international union subscription to be met ($26,000 in 2001) and it is recommended that an approach be made to MFAT requesting that they partially meet future SCAR subscriptions.

NON-DEPARTMENTAL OUTPUT CLASS 01 – MARSDEN FUND

Overview

Purpose and Objectives

The investment in the Marsden Fund purchases outputs that support and encourage excellence in the advancement of knowledge, underpin the knowledge base, and broaden and deepen the research skill base in New Zealand. The objectives of the Marsden Fund are also to enhance the quality of the research environment in New Zealand by creating increased opportunity to undertake investigator-initiated research. In so doing, the Marsden Fund is supportive of national and international linkages and multidisciplinary research.

Scope and Scale

In 2000/01, the Marsden Fund operated as a separate Output Class under the Innovation Goal of the RS&T system, with a 2000/01 investment budget of $25.839 m (5.45% of Vote RS&T). Following the 2001/02 budget, the Marsden Fund remains a separate Output Class under a renamed "Knowledge Goal", with an allocation of $27.839 m (22.7% of the Knowledge Goal investment, 5.73% of Vote RS&T).

Funding is provided for projects in the humanities, social sciences, sciences and engineering. In the 2000/01 year, 330 research contracts were operational.

Each year, approximately one third of the total budget becomes available for new projects. The distribution of funding by research area, for contracts commencing in the 2000/01 year, is shown in Figure 1. Of these new research contracts, 56% of the funding is for medical and life sciences, 32% for the physical sciences, earth sciences and mathematics, 7% for the social sciences and 5% for the humanities. This is practically the same as in the previous year.

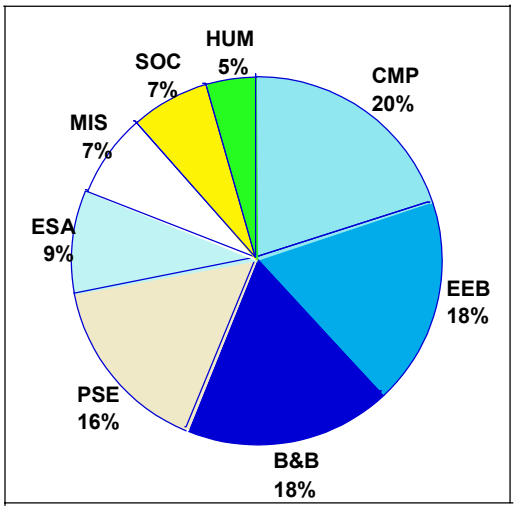

Figure 1: Funding by research area for new contracts in 2000/01.
The research areas are:
Cellular, Molecular and Physiological Biology (CMP);
Ecology, Evolution and Behaviour (EEB);
Biochemical and Biomedical Sciences (B&B);
Physical Sciences and Engineering (PSE);
Earth Sciences and Astronomy (ESA);
Mathematical and Information Sciences (MIS);
Social Sciences (SOC);
Humanities (HUM).

Providers and Users

Eligibility is unrestricted provided that the research is carried out either in New Zealand or, if its nature demands, carried out elsewhere by New Zealand-based researchers. Over the years, contracts have been awarded to universities, Crown Research Institutes, research associations and institutes, private individuals and companies. Universities as a whole are the largest providers and submit the great majority of proposals. Whereas most universities put forward

proposals in all areas of research, CRIs, by their very nature, usually concentrate on one or two areas of research. There are few applications from CRIs in the humanities, social sciences and mathematical and information sciences.

Funding by institutional group in the 2000/01 year is given in Figure 2. For administrative purposes each contract has a lead institution which is used in this figure, although many contracts involve collaboration with researchers at other institutions. The distribution of funding is similar to last year although the CRIs have dropped from 20% to 18%, benefiting equally the universities and the other providers.

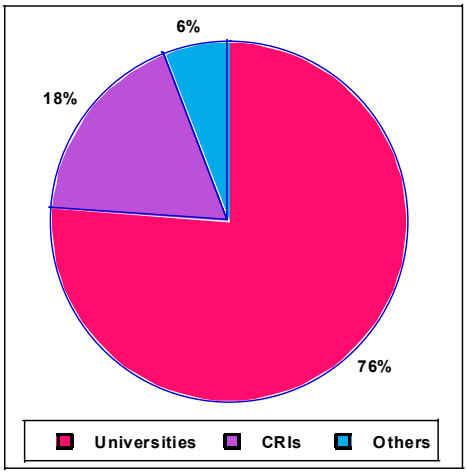

Figure 2: Funding of 2000/01 contracts by institutional type

Research carried out under the Marsden umbrella is fundamental research that provides underpinning knowledge and trained personnel for New Zealand's research and innovation system. Knowledge developed under Marsden may be used to further the research of the group that developed it but it is also made available to other researchers and specialist groups through publications, conference presentations, seminars and personal communications. In these ways, the research feeds into other projects and other parts of the RS&T system. Knowledge is also disseminated to the wider community through the national media, newsletters, community activities and teaching. The knowledge developed is sometimes of a serendipitous nature, leading to new fields of research or unexpected benefits. On occasions, research results can be withheld for a limited time to safeguard intellectual property. The continued development of a skilled research community, particularly through the training of new researchers, is also a significant element. This expertise becomes available to society as the emerging researchers join the work force or, in the case of senior researchers holding established positions, through collaborative endeavours.

Highlights

Key Features for 2000/01

The Marsden Fund invests in investigator-initiated research that is aimed at exploring the frontiers of new knowledge. It supports an extremely diverse range of fundamental research that reflects New Zealand's special character. Many of the issues are part of the usual public interest and debate – for example, genetic modification (including horizontal gene transfer), the environment, health, Maori, children and adolescents, natural hazards, climate change, information technology, and new materials and nanotechnology. A summary of the Marsden contribution to these key issues is tabulated in Appendix I.

Breakthroughs

"Every now and then something comes to fruition that has been in the pipeline for one's entire scientific career" – Professor David Parry, Massey University, on his breakthrough research on understanding the growth mechanism for hair".

This year, Marsden-funded research has resulted in several significant advances in the social sciences. In particular, the ambitious and widely publicised Youth First project reached a

conclusion. Researchers gathered testimonies from more than 1000 young people, describing their concerns and their visions of the future. They are now analysing the vast quantities of data obtained. The study was the first of its kind and its results have considerable implications for youth policy development. Another group has been analysing society's attitudes to punishment over the last century, and has found that in the last 30 years there has been a shift from support for "civilised" punishments, to a desire for harsher methods, often those involving public shaming. This shift appears to be linked to the erosion of many deeply embedded structures of social stability during this period. Another group's study of the New Zealand Native Schools system, which entailed gathering and analysing oral histories from over 250 Maori and Pakeha, has culminated in the recent publication of a book and should impact on education policies.

In the humanities, a study which received much media attention has shown that different New Zealand English dialects are beginning to emerge. They found three main dialect areas: (1) the northern half of the North Island, (2) a central region covering parts of both islands, and (3) southern areas of the South Island.

Exciting developments have taken place in biomedical research. Several groups are working on strategies to generate anti-tumour vaccines; their success is such that we cannot release details due to patent applications in process. A group studying the control of blood pressure has found that it cycles up and down with a regular 10 second rhythm, responding to rhythmic impulses from the nervous system. This finding has important implications for the diagnosis and treatment of cardiovascular disorders, and opens the door for studies of factors that influence the rhythm.

In molecular biology, a Marsden-funded group has demonstrated how hair grows, showing that the keratin filaments that constitute a hair strand shift relative to one-another during growth. This is groundbreaking research, explaining several anomalies that have puzzled investigators for years.

A group of behavioural biologists has found that homing pigeons sense the Earth's magnetic field when navigating long distances, using magnetic field intensity and direction of field slope as coordinates to determine direction. This may turn out to be a mechanism that is widely-used in the animal kingdom for long-distance navigation.

A number of projects focus on the interaction of organisms with their environment. Research on two species of kelp (nicknamed 'bionic kelp') that live on the wave-pounded shores of the New Zealand coastline, has revealed two very different strategies for coping with the non-stop thrashing. One species has an internal honeycomb structure, making it light and stretchy, and therefore tougher, while the other is at an equal density with the surrounding water, minimising the forces it is subjected to. Much national and international interest has been generated by another group's studies of why leaves are sometimes red. They found that red pigments (anthocyanins) protect leaves from the damaging free radical molecules generated by exposure to sunlight. This is an important finding given that plants (particularly in New Zealand) are having to cope with increasing levels of UV radiation due to depletion of the ozone layer. In an important collaborative spin-off, techniques developed for the leaf study are now being applied to medical research.

Marsden-funded geologists have discovered that isotopic ratios for hydrogen and oxygen in volcanic glass deposited in the North Island can be used to determine temperatures going back tens of thousands of years. This is noteworthy in that it is a record of climate in a temperate,

terrestrial environment, as opposed to a record derived from deep-sea sediments and ice cores. They have found that only small-scale climate changes have occurred over the last 1000-2000 years, but that global temperature 22,600 years ago was much colder than now. Gaining an understanding of these long-term climate patterns is crucial for interpretation of the climate changes taking place today. In another study, to be published in *Science*, geophysicists have determined that a particular signature of seismic waves detected at Mt Ruapehu has changed following the recent eruptions. This may provide a means of predicting the eruption of volcanoes.

In the physical sciences, atoms have been extracted from a Bose-Einstein condensate in the form of a coherent beam, the first step towards an "atom laser". There have also been significant advances in the theoretical modelling of condensates. Chemists studying the photochemistry of aerosols have a model that can account for the runaway greenhouse effect on Venus. A project investigating the formation of complex molecules in the atmospheres of planets and in outer space has led to further development of a gas sensing instrument which has enormous potential as a sensitive "sniffer" with applications in, for example, medicine, environmental monitoring and airport security.

One of New Zealand's foremost applied mathematicians, Professor John Butcher, had the honour of being invited to contribute to a review of numerical analysis, writing a review paper entitled "Numerical methods for ordinary differential equations in the 20th century". New Zealand mathematicians are some of the world's leaders in understanding the mathematical basis of computer algorithms and their efficiency. One group has developed a method, "parameterized complexity", which considerably simplifies many computational problems and may be used for many purposes including computational biology and internet applications. Another group has shown that quantum computers of the future will be able to handle numerical routines that are beyond today's computers. This will allow the "very best" solutions to be found for a diverse range of problems.

Research strengths and areas under-represented

An important feature is the diversity of Marsden-funded research being carried out. This provides a robust setting for new ideas. The range of new methods and skills being developed also provides a launching pad for the exploration of areas of research which may not be envisaged at present but which will be important fields in the future.

However, projects carried out in the 2000/01 year feature areas of concentration of effort and research strength. These are listed in part 1 of Appendix II. There are also areas of research which are under-represented – either because there are few Marsden applications in those areas or because the applications have not been successful. These are given in part 2 of Appendix II.

Progress and Achievements Evaluation

(i) Achievements

As discussed in other sections Marsden Fund researchers continue to produce high quality research outcomes. In addition there have been three new endeavours during the year - to encourage researchers at the start of their careers, to "track" postdoctoral fellows and to strengthen networks with overseas funding agencies.

The Marsden portfolio has been enhanced by a "Fast-Start" programme for emerging researchers. These are people who are often heavily burdened by the challenges of their new careers and this gives them an opportunity to quickly develop their research capabilities. The

Fast-Start programme is targeted at researchers, with staff positions at New Zealand Universities, Crown Research Institutes and other research organisations, who are trying to establish independent research careers and create research momentum. Such people are eligible for this programme if they have no more than 7 years' research experience since completing their PhD and if they have not previously been principal investigators on Marsden Fund contracts. Proposals can be for up to $50,000 per year for two years. The Fast-Start initiative has been welcomed by the research community - many favourable comments have been received and 20% of all applications in the 2001 round have been in the Fast-Start category. The analysis of applicants for the 2001 preliminary proposals shows there has been a shift from associate to principal investigators for people within 5 years of receiving their postgraduate degrees. That is, the figure for principal investigators in this range has increased from 16.4% last year to 21.7% this year and there has been a corresponding decrease for associate investigators from 19.5% last year to 14.3% this year. This appears to be caused by the Fast-Start programme having the intended effect of encouraging people at the start of their careers to take a more leading role in research. The first Fast-Start contracts will begin after 1 October 2001 and so will be analysed in next year's report.

The Royal Society, along with the Foundation for Research, Science and Technology and the Health Research Council, have commissioned a survey of postdoctoral fellows and postgraduate scholars, to determine the effectiveness of the investment for both New Zealand and the fellows and scholars. The survey is currently underway, with questionnaires having been sent to several hundred recipients. Results and analysis will be available towards the end of 2001.

In June, the chair and manager of the Marsden Fund visited more than 20 different funding agencies in Germany, England, Ireland, Sweden, Finland, USA and Canada, to ensure that our processes measure up to international standards, to explore opportunities for NZ researchers, and to strengthen our international networks. We concluded that our standards are excellent but it is always worthwhile considering other ways of operation. It is interesting that no matter what the size of the funding, there were concerns that were common to all (including the Marsden Fund), such as ensuring that interdisciplinary research is not penalised by the assessing system, that panelists are not only good researchers but include younger people, and that systems are in place to encourage emerging researchers. Our methods of monitoring research aroused interest and some agencies would like to consider moving to a similar scheme. The agencies were all keen to encourage collaboration with researchers here.

The larger agencies had the luxury of accepting applications at any time. Some had excellent schemes for publicising research and making the results more generally known. Others targeted special areas to encourage interdisciplinary research. Centres of Research Excellence or similar groupings were of great and timely interest to us given the developments in New Zealand. The Marsden Committee will be discussing the information we gathered and evaluating it to see whether some ideas can be usefully adapted to use here.

We have made many valuable contacts and are now part of an excellent network of funding agencies. We can also access this network for identifying referees in those cases, such as multidisciplinary research, for which it is difficult to find appropriate referees.

(ii) Key Indicators

The following key indicators have been chosen to represent the purpose and objectives of the Marsden Fund and have been grouped accordingly.

"Current contracts" refers to those operating in the government financial year indicated.

Excellence in the Advancement of Knowledge	**1999/2000**	**2000/2001**
For current contracts (excluding those awarded in the year's funding round), the percentage for which work has been presented at international conferences	67%	63%

Underpinning the Knowledge Base	**1999/2000**	**2000/2001**
Number of current contracts	324	330
Number of contracts completed	61	63
For completed contracts, the number of published peer-reviewed papers and conference proceedings	420	441
For completed contracts, the number of conference and workshop presentations	413	472

Broadening and Deepening the Research Skill Base	**1999/2000**	**2000/2001**
Number of separate individuals acting as principal and/or associate investigators on current contracts	660	729
Percentage of female PIs* on contracts awarded in the funding round	18%	18%
Percentage of Maori PIs and AIs* on contracts awarded in the funding round	1.6%	0.9%
Percentage of PIs in the year's funding round who have received their highest degree within the last ten years	26%	27%
Percentage of contracts in the year's funding round which have funding for postdoctoral fellows*	47%	44%
Percentage of contracts in the year's funding round which have funding for postgraduate students*	47%	70%

Quality of the Research Environment	**1999/2000**	**2000/2001**
National Collaboration – Percentage of successful proposals in the year's funding round with New Zealand PIs and/or AIs from outside the host institution	30%	25%
International Collaboration – Percentage of successful proposals in the year's round with PIs and/or AIs from overseas	30%	34%
International Collaboration – Percentage of current contracts with international collaboration (excepting proposals funded in the year's funding round)	73%	67%
Multidisciplinary Research* – Percentage of successful proposals in the year's funding round in which more than one discipline is represented† (†according to OECD Research Classification Codes)	40%	41%

***PIs** - Principal investigators - are 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.
AIs - Associate investigators - are researchers who play a lesser role than principal investigators and sometimes are involved with only limited aspects of the work.
Postdoctoral fellows are emerging researchers who have completed a PhD, usually within the last few years, and are employed on contract (often of 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.
Postgraduate students are researchers who are working on a Masters or PhD thesis.
Multidisciplinary research is that in which two or more disciplines are brought to bear.

The indicators point to a significant international presence, in terms of both collaboration and in the presentation of results at fora and in journals. The indicators for the skill base show a strong commitment to young researchers, with 27% of principal investigators having received their highest degree within the last ten years and a large involvement of postdoctoral fellows and

postgraduate students. The number of Maori is small but consistent with the percentage of Maori researchers nationwide, while the number of female principal investigators has remained close to, but below, the expected number.

Indicators for excellence could also include journal impact factors and citation rates but these require a database of publications. The software for the publication database has been written and the database is being set up currently. At present we do not have access to citation rates but the possibilities of collaboration with other agencies to do this are currently being discussed with MoRST. A limited analysis of citations was included in the 1999/2000 Royal Society Strategic Report.

Further quantitative indicators are included in Appendix III.

Qualitative Account of Achievements
A listing of qualitative achievements is also included in Appendix III. In addition, a short questionnaire has been sent to nearly all contact principal investigators on current and past contracts. The questionnaire is reproduced in Appendix IV and an analysis is given in Appendix V. The main findings, elaborated in the appendix, are that Marsden funding caused:

- Flow-on effects beyond the boundaries of the project funded, including changing of research direction and feeding into applied research or commercial ventures
- Long-term increases in the research capabilities and the size of research groups
- Positive impacts on career and in retention, and attracting to NZ, of trained researchers
- Funding to be gained from other sources, including overseas agencies
- The establishment of collaborations with other research groups, both within and outside of New Zealand

Also listed in Appendix III, section 4.4, are some additional outcomes from Marsden research – serendipity, patents and resources – which arise, on occasion, from basic research.

Intention of Investment
The indicators summarised above and detailed in Appendix III show that the Marsden Fund is fulfilling its objectives. Supporting evidence comes from the endorsement of the Fund from the researchers themselves, as recorded in Appendix V. A few of many supportive comments are listed below.

Excellence in the Advancement of Knowledge
"The Marsden Fund is critical to the long-term health of science in New Zealand. It is the essentially the only source of funding in NZ for which 'research excellence' on an international scale is an essential element of the research."
"Marsden has lit a fire under the academic science community … it is now possible to aspire to the same heights as our overseas colleagues and often possible to out compete them."

Underpinning the Knowledge Base
"Marsden projects are an investment with very high potential for return, not despite their support being aimed at the basic research level, but because they are aimed at this level where true innovation occurs."

Broadening and Deepening the Research Skill Base
"It is my strong belief that funding for pure research provides one of the most important keys to the future prosperity of New Zealand. The Marsden fund not only offers important opportunities for landmark discoveries, but also essential training for our most brilliant young minds. What better way is there to retain our future scientists in New Zealand, and to ensure that we retain our position as a world player in the fundamentally important arena of science and technology."

Quality of the Research Environment
"The most benefit in a Marsden is 'perception' - perception by potential young scientists that some 'good' science can be done here in NZ." "The discoveries upon which BLIS Technologies is based were derived through support of a researchers personal passion to follow a novel concept. This research would be unlikely to have been funded if the only support available was prescribed for investigations of other issues."

Considering "value for money", bibliometric studies[1] show that New Zealand is an efficient producer of research papers. Whether or not this is the case for Marsden-funded research, for which research papers are a primary output, has not been established. The Royal Society's Evaluation Officer will consider such questions in the coming year. It is clear, however, that strong international collaboration is leading to significant leverage of Marsden funding. For instance, researchers travelling overseas usually pay their fares from their Marsden grant but often have local expenses paid by the host organisation, amounting to a significant subsidy. On the other hand, researchers visiting New Zealand might be supported with local expenses and travel but this represents only a fraction of the true cost, including the visitor's salary. Examples of Marsden funding being extended in this way, generating additional research and international exposure, are listed in Appendix III, section 4.1.

[1] *A Bibliometric Profile of the New Zealand Science System*, Junjia Liu, MoRST, 2001

NON-DEPARTMENTAL OUTPUT CLASS 03 – SUPPORTING PROMISING INDIVIDUALS

This output applies to the James Cook Research Fellowships; and the Science, Mathematics and Technology Teacher Fellowships.

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 Fellowships allow them to concentrate on their chosen research for two years. These two years of dedicated research enable them to focus a lifetime of study and scholarship on issues that advance New Zealand's role in knowledge creation.

Fellowships are selected on the basis of:

- their academic and research record;
- scientific and technological merit of the proposed research;
- scope for intellectual and scientific development of the individual researcher;
- strengthening of existing and new research within the discipline
- Intellectual and logistical support offered by the host institution.

During 2000/01, there were eleven active Fellowships. These are listed in Appendix VI.

Applications in the areas of Physical Sciences, Biological Sciences, and Research of Relevance to the Peoples' of New Zealand and the South West Pacific, are being called for at present for Fellowships to start in April 2002. Professor Judith Binney has also asked for a one-year extension to her Fellowship and an extension has been approved until April 2003.

Highlights

Three Fellowships finished within the period and all produced excellent research during their tenure.

Dr Ken MacKenzie from Industrial Research Ltd finished his Fellowship in October 2000. His research topic *Structural studies of advanced ceramic materials* provides an example of scientific research that will benefit New Zealand and expand the knowledge base in the particular discipline:

Progress and Achievements Evaluation

The Society, via the Academy Council, receives 6-monthly and final Fellowship reports and general summaries and assesses the quality and progress of the research. All Fellowships have shown that progress with their research within any one 6-month period is very satisfactory and that the achievements have added to the knowledge base within the particular disciplines. Fellowships report that without the distraction of administrative burdens within their institutions, they are able to accomplish significantly more that usual. Assistance with expenses for the research is also much appreciated.

SCIENCE, MATHEMATICS AND TECHNOLOGY TEACHER FELLOWSHIPS

Overview

The New Zealand Science and Technology Teacher Fellowships offer primary and secondary teachers of the sciences, mathematics and technology the chance to improve their teaching with an injection of technological or scientific practice. In the time of their fellowship, teachers are able to experience the transformation of knowledge into useful products or systems, fully immerse themselves in research and so strengthen their understandings of the nature of science, or become more skilled in the communication of science and technology. Whatever they do, the evidence shows that they return to the classroom and their students rejuvenated and inspired (Science and Technology Teacher Fellow Evaluation, Jordan and Galt, 1999). They pass that inspiration and enthusiasm on to their students.

The number of Teacher Fellowships awarded has increased since 1994:

Year	1994	1995	1996	1997	1998	1999	2000	2001
Number	17	19	19	15	16	17	36	40

There were 98 applications for the 2001 school year compared to 54 for the 2000 school year.

Who is involved

In addition to the so far voluntary panels, 5 Society staff are directly involved: manager, administrator, and 3 other education staff who provide advice (internally and to applicants) and monitor selected Teacher Fellows. External organisations involved are the professional teacher organisations (in sciences, maths, social sciences and technology) in terms of promotion of the programme; research institutions, universities, polytechnics, and enterprises such as industries, local government, art galleries, zoos and science centres.

Highlights

- The co-presentation of a paper on apple physiology at an international research conference in British Columbia by Ian McIvor; the development, production and marketing of a fuel-monitoring device by Sam Lyle; collaborative research with the CRC for Marsupial Research by Ray Zinsli; contribution to research knowledge in fungal endophyte colonisation of grasses and kiwifruit management by Mike Seawright and Phil Webb; acceptance of a paper by *Science Education International* on environmental education by Margaret Yorke; and evaluation and advice to the Ministry of Education on Linux software system by Karen Woodruffe.
- The contribution to new knowledge made by teacher fellows
- Increased uptake by teachers of social sciences and mathematics

Barriers

There are a number of barriers, such as: the current work-load of teachers; the introduction of new qualifications systems and (until 2001) new curriculum statements; a shortage (dire in the case of Maori speakers) of replacement teachers as Boards of Trustees will not release teachers unless satisfactory replacement teachers are available; the perception by teachers that they are not qualified to put forward an application and lack of awareness of the programme by teachers.

Little can be done by the Royal Society about the first three factors, but the fourth is being actively addressed through promotion of the programme and support provided by Society staff

and previous teacher fellows. The fifth factor may be aided by the ability to offer an honorarium to panel members.
A difficulty in recruiting suitable members for the selection panels could be overcome by the offer of an honorarium.

Progress and Achievements Evaluation
Achievements of the programme have been demonstrated in the review by Jordan and Galt, the highlights above and can also be seen in the high level of continuing involvement and contributions by previous teacher fellows in the wider science and technology sector. Data is being collected by the Society on this to allow quantification in future reports, but anecdotal evidence demonstrates contribution through presentations to conferences, papers in professional publications, and involvement in curriculum and qualifications developments (especially through Ministry of Education and Colleges of Education contracts).

NON-DEPARTMENTAL OUTPUT CLASS 04 – PROMOTING A CULTURE OF INNOVATION

This output applies to the International Science and Technology (ISAT) Linkages Fund; the Management of the Science and Technology Promotion Programme; the Promotion of Science and Technology; the Science and Technology Publications; and the Royal Society International Memberships and Related Activities.

INTERNATIONAL SCIENCE AND TECHNOLOGY (ISAT) LINKAGES FUND

Overview

The ISAT Linkages Fund was established in 1994 to support New Zealand's international research, science and technology linkages. Its purpose is to ensure that New Zealand research, science and technology activities achieve full integration with the best international and development effort. The Fund provides funding for New Zealand researchers to establish collaborative work with international colleagues.

In 2000/01, four Contestable ISAT Linkages programmes which target support to researchers and institutions were administered by the Society. The programmes included:

- Bilateral Research Activities Programme (BRAP)
- NZ/USA Science and Technological Co-operative Science Programme (NZ/USA CSP)
- NZ/FRG Scientific and Technological Co-operation (STC) Agreement Programme (FRG)
- NZ/Deutsche Forschungsgemeinschaft (DFG) Programme

The purpose of the fund is to ensure that New Zealand science and technology activities achieve full integration with the best international research and development effort. The fund is also aimed at the younger qualified researchers, or where there are new linkages or activities.

Highlights

The effectiveness of the fund is highlighted by the fact that the collaborations allow the development of international opportunities to the recipients in enhancing their own innovation and also the utilization of overseas advances in research.

A feature of the reporting year was the awarding of grants to two Maori researchers: Associate Professor Linda Smith of the University of Auckland and Dr Stephen Bagshaw of Industrial Research.

Progress and Achievements Evaluation

Applications for funding are called for one or twice yearly with five or six eminent scientists servicing on assessment panels to evaluate the applications and to provide recommendations for funding.

In the year to 30 June 2001, 147 applications were received with 92 receiving funding. The total funding made available for the four programmes was $285,000.

The fund assists the visiting to international institutions and laboratories by New Zealand researchers and the hosting of overseas researchers in New Zealand, along with the exchange of

scientific information to increase the knowledge base and enhance the linkages between providers and users.

The fund contributes to a number of the Government's science envelope goals and outcomes.

The collaboration between New Zealand researchers and international colleagues and laboratories most often leads to the New Zealand researcher gaining new or enhanced innovative ideas.

The following table (for 2000/01) sets out the total number and value of each application received (by programme) and the total number of the applications supported and the value (also by programme).

ISAT Programme	Number of Applications Received	Amount of Funding Sought (GST incl)	Number of Contracts Awarded	Value of Contracts Awarded (GST incl)
Bilateral Research Activities Programme	75	$308,647	49	$148,500
NZ/USA Cooperative Science Programme	47	$219,133	23	$68,360
NZ/FRG Scientific and Technological Cooperation Agreement Programme	16	$73,845	13	$43,000
NZ/DFG Programme	9	$42,175	7	$25,000
TOTAL	**147**	**$643,800**	**92**	**$284,860**

The success rate of applications is as follows:

Bilateral Research Activities Programme	65%
NZ/USA Cooperative Science Programme	49%
NZ/FRG STC Agreement Programme	81%
NZ/DFG Programme	78%

MANAGEMENT OF THE SCIENCE & TECHNOLOGY PROMOTION PROGRAMME

Overview

Purpose and Objectives
This output supports promotion of values and attitudes supportive of science and technology as critical to future prosperity.

Outputs comprise maintenance and development of the Science Communicators Network, and management of the Role Models speaking programme and the *Wow! its science* website. Research on New Zealanders' attitudes to, and understanding of, science and technology. Development, co-ordination and measurement, in partnership with a provincial community, of a series of activities relating to science and technology.

Scope and Scale
The present programmes are outlined in Appendix VII.

Highlights

Auckland Festival

The inaugural Auckland Festival, branded 'Bump Into' Science and Technology proved to be a very successful venture. An estimated 95,600 people participated in the Festival, attending on average 3.6 events each. Almost 85% of participants who responded to a questionnaire said that their interest in science and technology had increased as a result of the Festival. Forty-two organisations took part, staging 373 events over the 7 days. The Royal Society contracted Caroline Cook, who is based in Dunedin, to organise the Festival, drawing on experience gained from the very successful biennial New Zealand International Science Festival in Dunedin

Role Models

The Role Models programme is gathering momentum, with a weekend at Te Papa planned for 10-11 November, in conjunction with FRST. Speakers have been enlisted to present a variety of programmes based loosely around the Body Odyssey exhibition including floor talks, public lectures, demonstrations and activities. The Role Models have been enthusiastic in their support of this initiative. Many networks are being created, such as with the Knowledge Wave Trust. Information about the RSNZ's promotion programme is now part of the Knowledge Wave's actions.

The role model programme has the potential to be a cornerstone of the communications programme. It encourages scientists to open their own dialogue, rather than having others speaking for them and uses the resources allocated to upskill, enabling good leverage of the investment and contributing to greater communication between science and society.

Progress and Achievements Evaluation

This output became part of the Purchase Agreement in January 2000. Details of each programme are available in Appendix IIV.

PROMOTION OF SCIENCE & TECHNOLOGY

Overview

Purpose and Objectives

Outputs comprise activities related to the development, administration and promotion of the "Young Investigators Club" (YIC); professional and logistical support to science and technology promotion activities for schools; activities to increase awareness about science and technology, particularly among students making career choices, parents, teachers, Māori and enterprise managers; and administrative support for students and teachers participating in science and technology programmes outside New Zealand and a contestable process to support activities that will result in New Zealanders having positive values and attitudes towards science, mathematics, social sciences and technology.

Scope and Scale

Successful projects for 2000/01 are listed in Appendix VIII.

Young Investigator's Club
The Young Investigator's club was an activity to provide support and encouragement to children aged 8-12 years old which terminated at the end of 2000 due to inability to find external sponsorship. A new venture, "*Scienceboard*", in conjunction with Hubbard Cereals is being developed from it. We were not able to realize our original hope that this would be able to be achieved without use of contract funds, but continue to seek external sponsorship.

Administrative support for students and teachers participating in science and technology programmes outside New Zealand
This component of the output comprises a range of activities with a mix of financial support, ranging from some entirely supported through MoRST to ones supported by private sponsors to one which is fully sponsored by the government of Singapore. The Purchase agreement provides the administration of the activities, and is part of the work of two Society staff members. The Society uses its networks through NZASE and TENZ to call for applications on a national basis for these activities, manages the selection process, and carries out all administration involved including maintaining the relationships with the international organisations.

The benefits associated with these activities include the exposure of talented New Zealand youngsters to the culture of science and the opportunity to work with others of like mind, the exposure to different ethnic cultures of the hosts as well as the other participants, and the intellectual challenge provided by the activities themselves.

Highlights
A Waikato-based festival celebrating technology, street performances, audiovisuals for Rutherford's Den, and a biodiversity trail are examples of what has been achieved with the 2000/01 round of the Promotion Fund. The National Science-Technology Roadshow Trust's "Ingenious Kiwis" exhibition, winner of the $100,000 grant, is well underway on its 2-year schedule and has attracted a large amount of additional sponsorship.

The success of Rawiri Waru of Rotorua Boys' High School at the Worldwide Young Researchers for the Environment expo in Germany as one of the seven finalists, achieving a full scholarship to Harvard University and job placement with du Pont.

International recognition of the role of the Society and NZASE through the election of Peter Spratt to the International Council of Associations for Science Education as Austral-Pacific representative.

Recognition by the International Technology Education Association of the role of TENZ through the election of the chairperson of its Board of Trustees, Alister Jones, as President of its Asia-Pacific region.

The inaugural Rutherford Medal was awarded to Professor Alan MacDiarmid, joint 2000 Nobel Laureate in Chemistry, by the Governor-General Dame Silvia Cartwright at a ceremony at Government House on 4 July 2001. In addition, 5 silver medals and 14 Bronze (called NZ Science & Technology Medals in 2001) medals were awarded. These medals were awarded in a variety of local ceremonies around New Zealand in the first half of 2001 and this exposure to local communities has been beneficial in raising the awareness of science and technology within New Zealand. Local events were covered well by the media.

SCIENCE AND TECHNOLOGY PUBLICATIONS

Overview

The Society, through its publishing unit SIR Publishing, synthesises, documents, and disseminates the results of New Zealand research, in seven internationally recognised refereed scientific journals and other types of publication in printed and/or electronic form, to the benefit of others and to complete the investment made in the research.

The market for the science journals is global and related to worldwide investment in science and technology. As the value of the "knowledge economy" continues to grow, there is reason to believe that the market is also likely to grow in those countries which are investing in science and technology.

Journal users are generally broken into Institutional and Individual subscribers. Traditionally, the Individual market is strongest within New Zealand, and Institutional markets are strongest overseas (especially North America). Within these sub-markets are others relating to geographic area of sales (United States, United Kingdom, Australia/Asia, New Zealand), discipline (subject), and regional scope of the individual journals: NZJMFR, NZJGG, NZJZ, JRSNZ focus on the Australasian, Pacific and Antarctic regions; NZJB is relevant to Pacific and Southern Hemisphere regions; NZJAR is relevant to temperate and subtropical regions; NZJCHS is relevant to crop and horticultural science worldwide.

Highlights

Journal Issues

New Zealand Journal of Marine and Freshwater Research has had a very high rate of submissions over the past few years, as a result of increased FRST funding in this area. In response to this, two, large 200+ page issues have been published this year, and an extra, fifth issue of the journal is to be published later in the year to ensure that all acceptable papers are published within good time.

New Zealand Journal of Geology and Geophysics published a 200-page special issue in March in honour of Dr Pat Suggate, entitled "Tectonic and climatic change in New Zealand", to mark Dr Suggate's contribution to New Zealand earth science of more than 50 years. The issue was launched at a function held at the Institute of Geological and Nuclear Sciences.

The Journal of the Royal Society of New Zealand also published a special issue – the 300-page "Advance in New Zealand mammalogy 1990–2000". This is an update to the popular "Handbook of New Zealand Mammals", published by Oxford University Press. Copyright of the issue is to be purchased by Oxford University Press for them to republish the issue in the revised edition of the Handbook.

New Zealand Journal of Agricultural Research, traditionally one of the strongest journals, has had a sudden downturn in submissions this year, and consequently the second issue is to be combined with the third issue to be published in September. Editors have written letters to institutional managers and relevant societies, visited researchers at conferences, produced a discussion document for possible future action, and sought comment via an email survey. Indications are that the former field-based research, which makes up much of the material published in the journal, is changing in favour of more specialised laboratory-based research, often as private contract material not available for general publication. However, if we can

attract the right papers through renewed promotional efforts, the consensus amongst agricultural scientists is that the journal will continue to be a highly desired publication.

Editorial Advisory Boards

All journals are soon to establish Editorial Advisory Boards, and suitable Terms of Reference have been drafted to do this. In 1991, when six of these journals were transferred to the Royal Society (from the DSIR), the Editorial Advisory Boards for the journals were disbanded with the intention that new boards be appointed in the future. Although one journal has established an Editorial Advisory Board, the other six journals have not, and some former board members have continued to support these journals in an unofficial capacity.

Editorial Advisory Boards provide prestige to journals and they need to be established for all the journals to support, enhance, and develop the publication of New Zealand's scientific research. The importance of Editorial Advisory Boards was noted by Cabinet in 1991.

Electronic Journals

A major question facing all science journal publishers today is the effect of electronic publishing, which is growing rapidly. Technological advances in communication have led to a demand for electronic access to published material. Institutional libraries, in particular, are demanding electronic availability of abstracts and full papers for quick and easy access and for economies of space and price. At present, only the SIR journal abstracts are published online.

SIR Publishing intends to take initiatives during 2002 to provide journals in a form that is seen by all subscribers to be more efficient and cost effective. Thus, an electronic publishing plan is in progress, whereby libraries and other subscribers will be offered the option of purchasing their journals in the form most appropriate to their needs.

Sales

Over the last few years there has been a worldwide decrease in library funding, which has seen a large number of subscription cancellations, especially of "marginal" regional journals in favour of larger "prestigious" journals. At the same time, the enormous benefits to libraries of electronic journals has added to the erosion of subscriptions to print journals. The SIR journals have experienced the effects of these cancellations. However, they appear to have now leveled out, and plans to introduce electronic publishing for the New Zealand journals should see a resurgence of journal usage.

Progress and Achievements Evaluation

2000/01 has been a progressive year for the journals, with a large number of promotional and operational initiatives either being carried out, or planning for them being set in motion. In addition, the core activities of editing, assessing and disseminating the results of the best of New Zealand's scientific endeavors to the world, have continued successfully.

Every paper published is internationally reviewed by leading researchers. This peer review is a measure of the quality of research that the journals publish. One-half to one-third of our reviewers are from overseas, and every paper is reviewed by at least two reviewers (i.e. between 80 and 180 reviewers per journal - over 1000 in total - were used during the subscription year 2000). We are increasing our use of overseas reviewers in an effort to improve the international recognition of the journals. For example, for NZJMFR, nearly 70% of the reviewers this year were from countries outside New Zealand. Also, authors travelling overseas have been beneficially used to promote the journals at international conferences and workplaces.

Awareness of the journals is manifest by the growing number of papers authored or co-authored by overseas researchers, which averages between 5% (for JRSNZ) and 25% (for NZJGG).

All the journals now have websites, and abstracts are also available online, together with guides to referees and authors, editorial reports, and survey results. Our records indicate that usage of these pages constitutes a consistently high proportion of the Society's total website usage.

Three-month averages of March-May show that Journal Publishing pages received 12.4% of all requests, and bytes downloaded were 21%. The average number of requests (hits) of the Journal Publishing pages was more than 28,000 over the three months.

ROYAL SOCIETY INTERNATIONAL MEMBERSHIPS AND RELATED ACTIVITIES

Overview
On behalf of the Government the Society is a member of the International Council for Science (ICSU), 16 international unions and 11 scientific associates and committees. The activity also provides support to New Zealand delegates attending international general assemblies / congresses and meetings etc.

Highlights
At the present time, five eminent New Zealand researchers hold a senior office on international union committees. In particular, Professor David Parry, Massey University is a member of the Board of ICSU, a very senior and prestigious position.

Professor Alan MacDiarmid's visit to New Zealand was an enormous success.

A flow-on activity from New Zealand's profile within ICSU and its impact within the global community has led to the 33rd International Congress of Physiological Sciences (IUPS) being held in Christchurch in August 2001. It is conservatively estimated that this congress has brought $NZ20 million into New Zealand.

Progress and Achievements Evaluation
During the reporting period the meetings and symposia have also received some financial assistance from the Society. These are listed in Appendix IX.

Financial assistance is also provided to NZ delegates to attend their respective international General Assembly's or Congresses. These are listed in Appendix X.

Reports have been received from the delegates. The reports have been assessed, recommendations considered and acted upon as appropriate. Copies of the reports are forwarded to the appropriate scientific societies and the delegates are asked to provide an article for appropriate scientific society newsletters. The Society's electronic newsletter "Alert" also features excerpts from these reports.

The Society continues to liaise with overseas visitors. A full list of international visitors to the Society during the reporting period is attached as Appendix XI.

REPORTING ON STEWARDSHIP EXPECTATIONS

Fostering Collaboration and Integration

The Royal Society actively promotes collaboration and integration by building and maintaining relationships with FRST, HRC, Universities, CRIs and other government departments. Groups such as the Purchase Agents meetings are important opportunities for exchanging information.

The Marsden Fund meets with evaluation staff from FRST to exchange information on methods of monitoring and evaluation of research and have also attended a FRST meeting on consortia. A FRST staff member, Marie Bradley, manager of the NERF Fund, addressed the Marsden Fund Committee on NERF, and a meeting has been held between NERF staff and Marsden staff. In a significant collaboration with FRST and HRC, the Royal Society is proceeding with a major survey of postdoctoral fellows and postgraduate scholars.

Excellent relationships exist with other government agencies (such as MFAT) and the various Embassies. International scientific activity is promoted to New Zealand's scientific institutions through the support of significant meetings, symposia etc.

We endeavour to build links with interested organisations at a variety of levels, for example the ISAT Co-ordinators and regular meetings with communications staff.

Smart Purchase

The Royal Society maintains excellent relationships with providers with a good flow of information both ways on criteria for selecting contracts. These strong relationships also facilitate the smooth running of existing contracts. In addition, panelists (about 60 for Marsden Fund alone) are asked to provide comments on any improvements to the process. This is a valuable source as these panelists come from a range of institutions and research areas and represent a variety of views. Many of them also have experience of participating in reviewing applications for international funding agencies.

The Society collaborates with relevant university departments and Crown Research Institutes to ensure people are aware of the up-coming opportunities. Potential applicants are able to contact the Society to discuss their application in regard to whether it fulfils the required criteria. For the Contestable Promotion Fund similar applications are contacted by the Society to explore working together.

First hand information on international best practice has been obtained by a visit to overseas funding agencies by the Chair of the Marsden committee and the manager of the Marsden Fund.

The Royal Society's Academy Council ensures that quality research is undertaken by James Cook Research Fellows, receives interim and final Fellowship reports and general summaries and passes opinion to the Society on the quality and progress of the research. Any unsatisfactory performance will be conveyed to the researcher so that standards can improved.

Publication in the New Zealand journals provides a measure of the relative importance of New Zealand science in a global context, enabling an international agreed point of reference for assessing excellence. Bibliometric analysis allows inferences to be made on how well and extensively the information contained is used.

Responsiveness to Maori

Marsden Fund

Redressing the low participation in the Fund by Maori (2% of principal and associate investigators but involved in 5% of the contracts in 2000/01) will require comprehensive long-term policies outside the Marsden Fund. However there is an ongoing programme to inform Maori researchers about the Marsden Fund. This has involved finding contacts for Maori researchers and visits to institutions and organisations interested in research relating to Maori. In this 12 month period we have had discussions with the Assistant Dean (Maori) of the Faculty of Science at the University of Auckland, with the Assistant Vice-Chancellor (Maori) at Victoria University, with the executive of Te Tapuae o Rehua Limited (a partnership of some South Island universities, other tertiary education institutions and Ngai Tahu), with Mr Edward Ellison from Te Runanga o Ngai Tahu, with Te Runanga o Nga Maata Waka and Te Runanga o Mangamaunu, and with individual Maori researchers. Information about the Fund was also supplied to the Te Puni Kokiri newsletter. We also expect to make links to the National Association of Maori Mathematicians, Scientists and Technologists when this association begins to operate again.

Currently there are several programmes of interest to Maori and some of these involve Maori researchers and students. They encompass a variety of social and cultural issues and include studies on the following:

- early settlement in New Zealand
- the languages of South Auckland
- Maori use of wetlands
- a social history and content analysis of the Maori language newspapers, 1840-1950s
- the theory and practice of Maori representation
- transformations in Northern Maori Society, c1200-1850 AD
- issues which affect young people, with an emphasis on Maori youth
- the link between bacterial immunity and cancer susceptibility relating to particular Maori families who are susceptible to stomach cancer

Some of these programmes provide active training in research for Maori students. In addition other programmes involve Maori researchers as principal or associate investigators.

In the 2000/01 year 3.2% of the total funding will go to programmes covering issues of interest to Maori and a further 3.5% on additional research programmes involving Maori as principal of associate investigators. That is, 6.7% of the funding is related to Maori either through the research topic or through enhancement of research experience and training.

Other Programmes

In the 2000/01 James Cook Research Fellowship round, 2 out of 11 applicants research was considered likely to benefit Maori.

The number of Maori teacher fellows is slowly increasing. The use of those involved in promotion of the programme to their colleagues will produce further increases. In school year 2000, 8% of the teacher fellows were Maori and 11% of the projects had direct connection and benefit to Maori. For 2001, 5% are Maori, and 20% have direct connection and benefit to Maori.

Two Maori researchers applied to ISAT for funding in the year of reporting with both receiving grants.

Creating dialogue on issues of science and technology with Maori is a key part of the Role Models initiative. The Society is in partnership with the National Association of Maori Mathematicians, Scientists and Technologists (NAMMSAT) to achieve this, with a direct initiative scheduled to begin early in the new year.

The 2001/02 round of the Promotion Fund encouraged applications that targeted Maori, since research shows Maori are largely un-attentive to science and technology. This year, three projects have Maori as their named major target (21% of funds), with several other projects targeting areas where high percentages of Maori and Pacific Islanders live.

Optimising Global Connectedness

While New Zealand is a modest player in international science and technology the quality of its science and technology capability, recognition and alliances continue to be important. New Zealand's international links have increased significantly over the past five years.

The Society facilitates links between local and international researchers on Marsden Fund contracts by funding contacts with international collaborators and by funding participation of the researchers in international conferences. Marsden Fund staff visiting researchers to monitor progress ask explicit questions about international links and collaboration.

As a consequence of the visit to overseas funding agencies by the Marsden Fund Chair and Manager, the Society is now part of an excellent network for exchanging information and for access to advice about funding processes and opportunities for New Zealand researchers.

All ISAT recipients undertake collaborative research with overseas researchers, either visiting other countries for a short period or hosting overseas researchers in New Zealand.

APPENDIX I

Marsden Fund contribution to issues of general public interest, 2000/01

Issue	Number of programmes[2]	Funding ($m)	Description
Genetic technology	73	10.1 (incl. 2.4 for use as a tool)	Programmes involving genetic technologies can be divided into 2 classes: 1) In laboratory-based studies, understanding the way in which genes work, in relation to general cell biology, protein biochemistry, plant function and human health. 2) Using genetic technologies as a routine tool to sequence DNA, for evolutionary, ecological and historical studies.
Environment	38	2.7	Programmes are investigating aspects of ecology, biodiversity, population genetics, plant physiology, oceanography and atmospheric science. Programmes of particular public interest include 3 genetic studies of threatened species (NZ saddleback, black robin and Hector's dolphin), the effect of introduced brown trout on a stream ecosystem, factors which determine the sex of tuatara and how giant New Zealand kelp withstands the battering of the ocean.
Health	60	5.9	Most programmes concentrate on fundamental aspects of biochemistry, cell biology and genetics. The foci of the programmes include the immune system, the nervous system, disease-causing organisms, degenerative diseases, cancer research, drug synthesis, gene therapy, and statistical and computational methods.
Maori	11	0.94	Programmes on archaeology, language, Maori language newspapers, the Native Schools System, political representation, museum practice, youth, and health.
Children and adolescents	7	0.68	These programmes cover the development of memory, how students learn and acquire knowledge, and children's rights including the right to be safe.
Natural hazards	9	0.56	Investigations of geothermal, volcanic or seismic activity.
Climate change	7	0.27	Six programmes determining past climate, which provides information for today's debate on climate change, and one investigating the mechanism by which the greenhouse gas carbon dioxide is permanently trapped by the oceans.
Information technology	20	1.2	Programmes researching computer architecture, software, data transmission, artificial intelligence, numerical computation and the theory of computation.
New materials and nanotechnology	20 (incl. 9 in nanotech.)	2.2 (incl. 1.0 in nanotech.)	Studies of new materials, including the development of materials and material processes for nanotechnology.

[2] Note: some programmes fall into more than one category.

APPENDIX II

1. Areas of strength in Marsden-funded research

Panel	Strengths
Biochemical and Biomedical Sciences (B&B)	Two particular areas of strength can be seen in immunology and neurobiology. A number of other areas with outstanding projects include cell physiology, molecular biology, developmental biology, microbiology and pharmacology (particular strengths at Auckland and Otago Universities).
Cellular, Molecular and Physiological Biology (CMP) and Ecology, Evolution and Behaviour (EEB)	The following are strongly represented: molecular evolution, microbiology, plant molecular biology, structural biology, animal physiology and organism-organism interactions (both at the ecological level and also the parasitism level). There is an overall increase in successful plant-based projects. The issue of horizontal gene transfer is being raised as a significant issue with respect to the growth of genetically modified crops in the field. Marsden has funded four studies which should provide information to assist in this area of concern: • "Horizontal gene transfer in bacteria - Challenging our concept of bacteria as autonomous organisms", Dr J Young (Landcare); • "Predicting evolutionary trends in extrachromosomally-encoded disease: why be pathogenic?" Dr M O'Callaghan (AgResearch); • "Decoding the Symbiotic Island of *Mesorhizobium loti*", Dr J Sullivan (Otago University); • "Evolution of a microbial genome", Assoc. Prof. C Ronson (Otago University).
Physical Sciences and Engineering (PSE)	Strong areas are organometallic and inorganometallic chemistry, synthesis (related to complex, biologically important natural products including carbohydrate chemistry), fundamentals of molecular architecture and how this relates to molecular properties and function, and materials and supramolecular chemistry. New Zealand has excellent strength and demonstrated global leadership in key areas of physics such as Bose-Einstein condensates, atom and optical laser physics, optics, magnetism, condensed matter and fundamental studies to understand the nature of the boundary between classical and quantum physics. Marsden-funded studies in nuclear magnetic resonance and fluid dynamics have helped to create a globally-recognised centre of excellence in this area.
Earth Sciences and Astronomy (ESA)	Strong areas are climate-related research, especially climate processes, fluid physics, astronomy, tectonics and geochronology.
Mathematical and Information Sciences (MIS)	Marsden is funding an impressive range of topics, including statistical analysis and modelling, biomathematics, abstract geometry and analysis, theory of computability, combinatorics and computational algebra, physical applications, computer architecture and graphics, and numerical analysis and computation.
Social Sciences (SOC)	Anthropology, psychology and education are very well represented.
Humanities (HUM)	Strong areas include the Print Culture initiative, 17th century NZ literature, 19th century New Zealand history, New Zealand linguistics and ethics; also Maori studies ranging from print media through to current museum practices. The wide diversity of disciplines funded, of national and international importance, contributes to the strength in the humanities.

2. Areas under-represented in Marsden-funded research

Panel	Under-represented areas
Biochemical and Biomedical Sciences (B&B) and Cellular, Molecular and Physiological Biology (CMP) and Ecology, Evolution and Behaviour (EEB)	Pharmacology may be underrepresented in the sense that basic research in this area may make way for the development of new treatments, and resultant new commercial opportunities, in the future. The full strength of plant and animal genomics and bioinformatics, both emerging fields, are not yet being seen in Marsden applications. It may be the case that such development is being held within the institutions and not moving into public research areas.
Physical Sciences and Engineering (PSE)	One possible gap in the Marsden applications is biochemical pathway studies. Recognising that molecular biology and genetic engineering has potential to create hybrid or transgenic organisms which could produce novel, valuable metabolites opens an opportunity for chemistry to contribute to the biosynthesis routes and metabolite studies. A recognised gap is in the area of atomic physics, which can be accessed from a theoretical viewpoint in New Zealand, but, owing to the enormous cost of equipment for experimental work in this area, will most likely never be carried out here. Another possible gap is in the area of fundamental studies in remote sensing. There are few applications in engineering, which may be due to the availability of other funding and the applied nature of many engineering projects. However, there are some gaps. These could include fundamental elements of telemetry, very large structures (with elements of earthquake engineering) and in the area of fuzzy logic and device control.
Earth Sciences and Astronomy (ESA)	There are gaps in soil microbiology, lower atmospheric processes and hydrology. There is also a concern about alternatives for funding astronomy as, at present, the only funding sources are the Marsden Fund and internal university funding.
Mathematical and Information Sciences (MIS)	No obvious gaps.
Social Sciences (SOC)	Geography, sociology, economics and linguistics are under-represented. The lack of representation of law and the lack of studies in the business studies/management area are a concern. There also appear to be only a small number of cross-disciplinary projects.
Humanities (HUM)	Classics, Asian studies, Pacific studies, NZ art history, modern languages and religious studies are under-represented.

APPENDIX III

QUANTITATIVE INDICATORS AND QUALITATIVE ACHIEVEMENTS

1 Excellence in the advancement of knowledge

The quality of Marsden-funded research is ensured by rigorous selection procedures. During 2001 the software has been developed for setting up a database of publications – both to act as a resource for others on the Society's website and also to be used to evaluate the quality of the publications. With the appointment of a Database Administrator and an Evaluation Officer, measures for the quality of publications will be further developed. Measures of research excellence for contracts current in the 2000/01 year are as follows:

- Papers on current and past Marsden contracts have been published in prestigious journals with high impact factors such as *Nature, Science, Structure, Nature Structural Biology, Genes and Development, Physical Review Letters, Angewandte Chemie, Nature Medicine, Journal of Biological Chemistry* and *Proceedings of the National Academy of Sciences.*
- The results from 63% of contracts have been presented at international conferences.
- Of the 11 holders of the prestigious James Cook Research Fellowships with tenure during the 2000/01 year, 5 are principal investigators on Marsden contracts.
- Principal investigators on current contracts include 66 who are Fellows of the Royal Society of New Zealand.
- Numerous prizes and awards to Marsden researchers, as listed in Table A1. These include both New Zealand and international recognition, for principal and associate investigators and postgraduate students funded in Marsden programmes.

Table A1: Prizes and awards for Marsden-funded researchers

Marsden researcher (Contract)	**Distinction awarded**
Professor V O'Sullivan (VUW904)	awarded Distinguished Companion of NZ Order of Merit
Professor PT Callaghan (MAU006)	awarded Fellowship of the Royal Society of London (FRS)
Dr G Le Gros (MIM802)	2001 James Cook Fellow (RSNZ)
Professor G Martin (UOA811)	2001 James Cook Fellow (RSNZ)
Professor D Penny (MAU905)	NZ Association of Scientists Marsden Medal 2000
Assoc. Prof. MP Murphy (UOO803)	NZ Association of Scientists Research Medal 2000
Professor DAD Parry (MAU903)	2000 Sir Charles Hercus Medal (RSNZ)
Dr G Jones (UOO010)	2000 Hamilton Prize (RSNZ)
Professor GW Tannock (MAU907)	NZ S&T Silver Medal 2000 (RSNZ)
Dr MM Walker (UOA824)	NZ S&T Silver Medal 2000 (RSNZ)
Dr G Weir (IRL901)	NZ Mathematical Society Research Award 2000
Professor R Ballagh (PVT902)	appointed Fellow of the Royal Society of NZ
Professor D Bridges (UOC007)	appointed Fellow of the Royal Society of NZ
Professor M Dragunow (UOA903)	appointed Fellow of the Royal Society of NZ
Professor M Hendy (MAU004)	appointed Fellow of the Royal Society of NZ
Professor C Higham (UOO007)	elected to British Academy
Professor CW Gardiner (PVT902)	Honorary Doctorate of Natural Sciences at the University of Innsbruck
Professor WR Roper (UOA802)	awarded the Dwyer Lectureship, University of New South Wales
Assoc. Prof. LJ Wright (UOA802)	received the Annual Award from the Society of Pure and Applied Co-ordination Chemistry
Dr B Lawrence (UOC701)	elected on to the International Commission for Middle Atmosphere
Professor J Astley (UOC907)	elected to the Board of Directors of the International Institute of Acoustics and Vibration

Dr JS Fleming (AGR701)	Commissioner for the Royal Commission on Genetic Modification
Professor JC Belich (UOA819)	Fulbright Visiting Fellowship
Dr M O'Callaghan (AGR801)	NZ Federation of University Women fellowship for travel to overseas conference
Professor BJ Copeland (UOC905)	website has received a Britannica Internet Guide Award
Dr G Whittle (VUW901)	MSc student Rhiannon Hall was awarded a Commonwealth Scholarship
Dr SPA McCormick (UOO804)	PhD student Rebecca Sharp won an Otago student paper competition
Dr M O'Callaghan (AGR801)	PhD student Steve Dodd won a Young Investigators Travel Award for travel to a NZ conference
Dr GR Tompkins (UOO906)	summer student Betty Keng won an award to present work in Japan

2 Underpinning the Knowledge Base

Developments in the social, economic and cultural environment depend on a growing knowledge base arising from basic research. Internationally accepted measures of contribution to knowledge are that the work is reviewed by experts and is published. Publication of results is a requirement of Marsden-funded research and a high level of productivity has been achieved. Where appropriate, other types of knowledge dissemination are encouraged.

In the 2000/01 year there were 257 existing contracts (plus 73 new contracts from the 2000 funding round, for which no information on the research has yet been received). Of the 257 contracts, 63 had presented their final reports by the end of the year. Publications and outputs to date arising from these completed contracts are listed in Table A2.

Table A2: Publications and other outputs for 63 contracts completed in 2000/01

Publications
• 346 papers published in refereed journals (including 69 papers in press)
• 50 papers submitted for publication
• 5 books published (including 1 in press)
• 10 book chapters published (including 5 in press)
• 95 refereed conference proceedings (including 9 in press)
• 14 PhD and 24 Masters' theses
Conferences
• 472 conference and workshop presentations
Other
• 7 internal reports
• Various popular magazine, journal and newsletter articles
• At least 57 overseas seminars (plus many in New Zealand)

3 Broadening and Deepening the Research Skill Base

3.1 Investing in New Zealanders with knowledge, skills and ideas

Christopher Palliser once worked at Government House as a kitchen-hand and for 12 years was a nurse. Gaining an interest in statistics through a nursing project, he completed Bachelors and Masters degrees in mathematics at Massey University and enrolled in a PhD. For part of his doctorate, he was employed on a Marsden-funded project at IRL on the deposition of ore deposits in geothermal fields. He then turned his hand to the structure of proteins, as a Marsden-funded postdoctoral fellow. He has now taken up a position as a computer modelling scientist with Dexcel limited in Hamilton.

The Marsden Fund has supported and retained skilled New Zealanders by:

- Funding contracts starting in the 2000/01 year that involve 116 principal investigators (of whom 95% are based in New Zealand) and 105 associate investigators (of whom 65% are based in New Zealand).

3.2 Investing in emerging researchers

The Marsden Fund invests heavily in emerging researchers. Evidence for this is:

- The Marsden Fund's contracts are collectively New Zealand's single largest employer of postdoctoral researchers. From contracts awarded between 1996 and 2000, funding has been available for postdocs in 42% of the contracts. In the 2000/01 year, 35 new postdoctoral positions have been supported.
- From contracts awarded between 1996 and 2000, funding has been available for postgraduate students in 55% of the contracts. In the 2000/01 year, 51 new postgraduate positions have been supported.
- A Fast-Start category has been introduced into Marsden applications, to encourage emerging researchers to apply for Marsden grants.
- In the 2000/01 funding round, 27% of all principal investigators and 43% of all associate investigators are within just 10 years of completing their highest degree, usually a PhD (that is, in most cases, are under 35 years of age). These figures are practically the same as for the preceding year and are higher than would be expected from demographic considerations (Figures A1a and A1b).

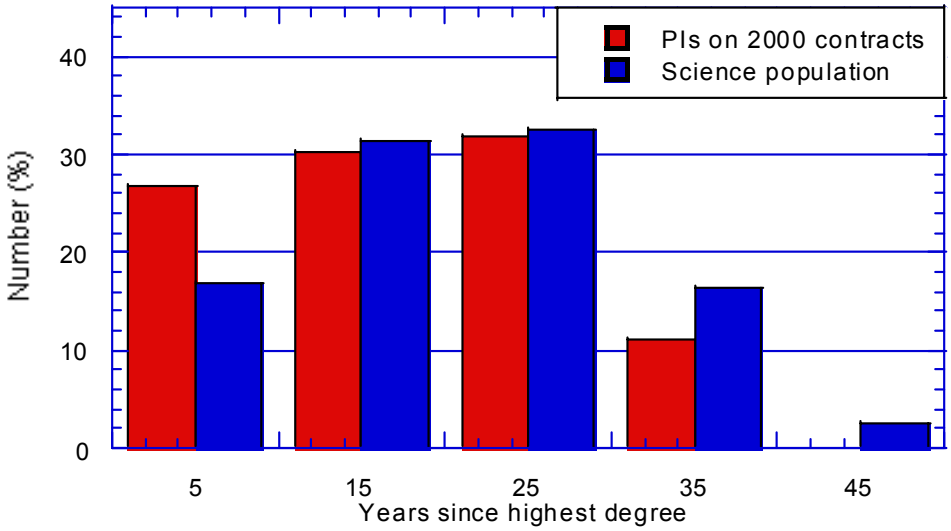

Figure A1a: Experience of principal investigators (PIs) on contracts awarded in 2000, as measured by the number of years since the principal investigator obtained their highest degree. Since 85% of contracts are in the science area, this distribution for principal investigators has been compared with the distribution of ages of New Zealand scientists, from *Profiles – A Survey of New Zealand Scientists and Technologists*[3]. [Note: the horizontal variables (*years since highest degree* and *age*, respectively) have been matched by assuming that the highest degree is

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

obtained at 24 years of age.] The data show that the number of younger principal investigators is higher than could be expected on the basis of demographics alone. However, experienced researchers also play a significant role.

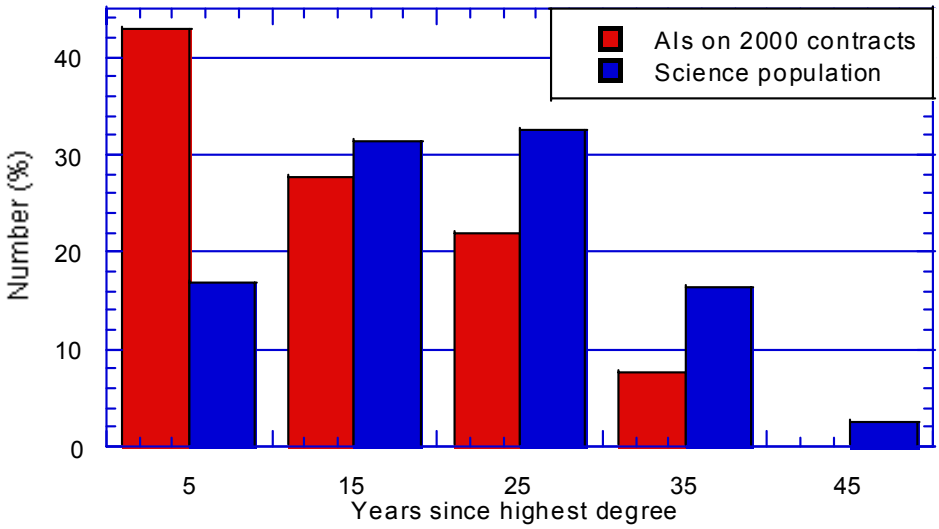

Figure A1b: Experience of associate investigators (AIs) on contracts awarded in 2000, as measured by the number of years since the associate investigator obtained their highest degree. The contribution of young researchers is even more marked than for principal investigators (Figure A1a).

3.3 Supporting participation of women

Women are under-represented in the sciences. Data from the 1996 Census show that, excluding engineers, 23% of scientists are women. (The Census data do not include the social sciences and humanities, which account for about 15% of Marsden applications). The figure of 23% is the same as that obtained in a survey published by the Royal Society[4]. In 2000/01, 18% of the principal investigators on successful applications are women, essentially the same percentage as on preliminary applications and close to the percentage of women scientists.

The Fund has actively promoted the participation of women by:

- Promoting through the media the achievements of female researchers on Marsden contracts.
- Maintaining gender balance in management, assessing panels and the Marsden Fund Committee.
- Encouraging women as principal and associate investigators. The percentage of principal investigators who are women has increased threefold since the 1995 round. These trends are summarised in Figure A2.

[4] *Profiles - A Survey of NZ Scientists and Technologists*, J and D Sommer, The Royal Society of New Zealand, 1997

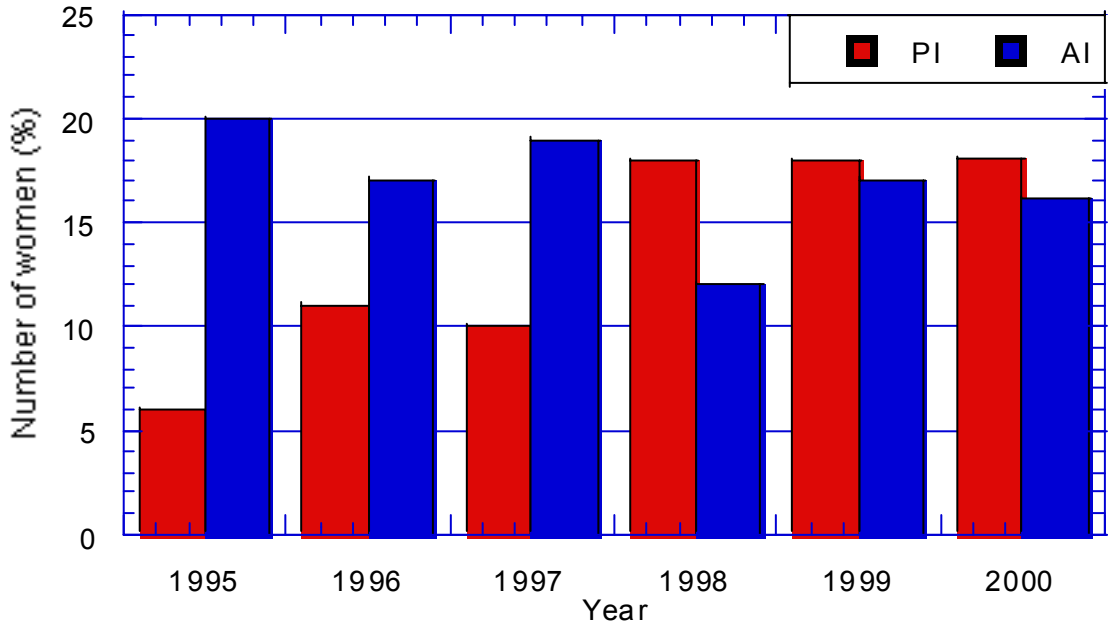

Figure A2: Percentage of investigators, principal (PI) and associate (AI), who are women. For the last 3 funding rounds, the number of women principal investigators has been steady at 18%, close to but less than the percentage of women researchers.

3.4 Supporting participation by Maori

For contracts active in the 2000/01 year, the percentage of principal and associate investigators who are Maori is approximately 2%, although Maori researchers contributed to 5% of the contracts, mainly in the social sciences and the humanities. In the 1997 RSNZ survey (referred to above), 0.7% of scientists were identified as Maori.

In the last year, the Marsden Fund has actively sought to increase the participation of Maori in fundamental research by:

- consulting with university staff who have specific responsibility for Maori issues
- consulting iwi and runanga
- contributing to the Victoria University Science Faculty mentoring scheme, Te Roopu Awhina Puutaiao
- Marsden staff undertaking courses in Te Reo Maori

4 Quality of the Research Environment

4.1 Supporting collaboration

The proportion of the contracts involving principal and associate investigators at more than one institution has risen steadily from 23% in 1995 to 53% in the 2000 funding round. The research groups have both national and international collaborators, as shown in Figure A3.

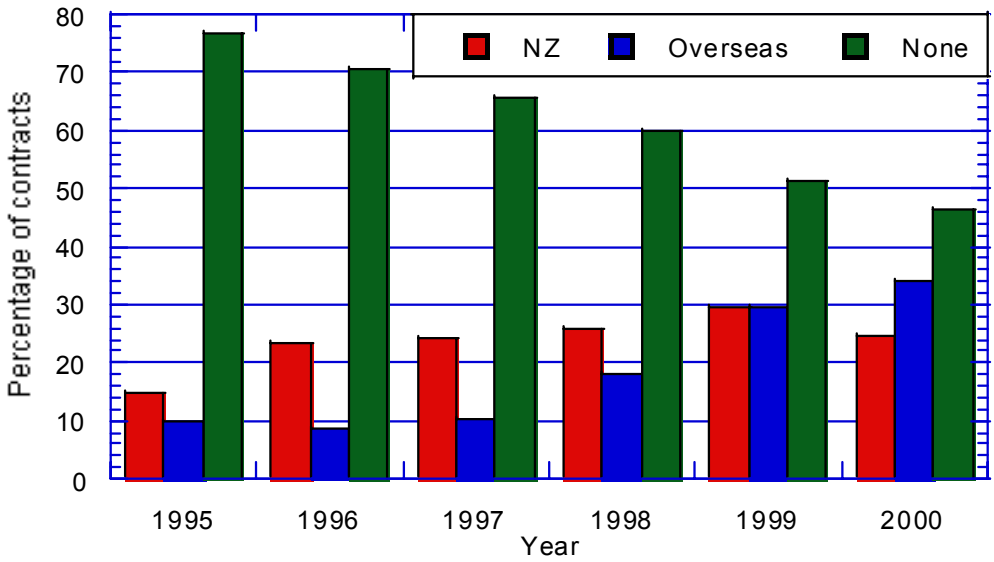

Figure A3: The percentage of contracts for which a principal or associate investigator is from outside the host institution, categorised according to whether the collaborator is from New Zealand or from overseas. The percentage of contracts having no such formal collaboration is also shown and shows a steady decrease from 77% in 1995 to 47% in 2000. The year refers to the starting date of the contract.

The percentage of contracts that specifically include overseas principal or associate investigators has grown to 34% in the 2000/01 funding round. Further collaboration occurs during the course of the research and the percentage of current projects with international collaboration is 67%.

New Zealand research benefits from Marsden-funded international collaboration by:

- Using techniques, equipment and resources that are unavailable in New Zealand, often at no cost. Examples include:
  - the use of a neutron scattering instrument at Grenoble to study atomic vibrations within enzymes
  - the use of a high magnetic field laboratory in Oregon to study the conducting properties of high-temperature superconductors
  - examination of European fossil and shell collections for a project on the origins and development of New Zealand marine life.
- Sending New Zealand researchers, including students, to overseas laboratories to learn new methods and use equipment not available in New Zealand. Examples include:
  - the principal investigator learning physiological techniques at the University of Iowa which are to be applied to a study of the way sodium, an important element in cell function, is transported between cells
  - a student using fabrication facilities in the Netherlands as part of her study towards a PhD in nanotechnology
  - a student visiting the University of New Hampshire to collaborate on writing a computer program for his PhD in astrophysics
- Drawing on overseas researchers' knowledge by hosting conferences, workshops and individual visits. Examples include:

  - a workshop of 40 scientists to discuss, report and collaborate on research on mathematical problems of biology
  - a workshop on nanotechnology, of 120 scientists and engineers, including a Nobel prizewinner, and 20 local students
  - a yearly meeting on mathematics in which New Zealand-born Fields Medal winner, Professor Vaughan Jones, hosts some of the world's best mathematicians to work with local researchers and students
- Hosting overseas students to build links for the future. Examples include:
  - two PhD students from the National Research Council of Italy (CNR) visited New Zealand over the summer and contributed to a Marsden programme on computer-aided design
  - a PhD student from Seoul visited New Zealand to make optical measurements on carbon nanotubes
  - a German student funded from Germany by DAAD began a PhD in statistics
  - a PhD student, co-funded by the Danish Research Agency, is studying for her PhD on a Marsden programme in geology
- Leveraging Marsden funding with overseas funding. Examples include:
  - several postdoctoral fellows on one programme, funded by the German Research Society (DFG) and Alexander von Humboldt Foundation
  - a biomedical programme has received overseas funding for commercial development
  - a researcher has supplemented his Marsden grant by obtaining funding for visits from several overseas agencies, most recently the Volkswagen Stiftung (Germany)
  - a collaboration developed as part of a Marsden project has led to a new US-funded collaborative project
  - Marsden funding has been the springboard for another grant from the Bibliographical Society (London)
  - a Marsden award was the key in obtaining funds for a joint Canadian/NZ workshop on "International government and social spaces" funded by the Canadian Programme for International Research Linkages
  - considerable financial support from overseas institutions for a Marsden researcher to visit them
  - a major item of equipment was purchased for a Marsden programme using a grant from the Wellcome Trust, UK
  - 3 postdoctoral fellows, all with overseas funding, were attracted to one Marsden programme
  - a researcher visiting the Paris Natural History Museum had his Marsden grant supplemented by the Museum
  - the results of research funded by Marsden has allowed a researcher to obtain a visiting faculty fellowship while on sabbatical in the USA
  - the Japanese collaborators in a Marsden-funded astronomy programme have made a major donation of two CCD cameras

In the last 5 years, the percentage of contracts with some type of national collaboration has been steady at 25-30%, an increase on the 1995 figure of 15% (Figure A4). However, the diversity of national collaborations has increased, with the CRIs playing a more important collaborative role.

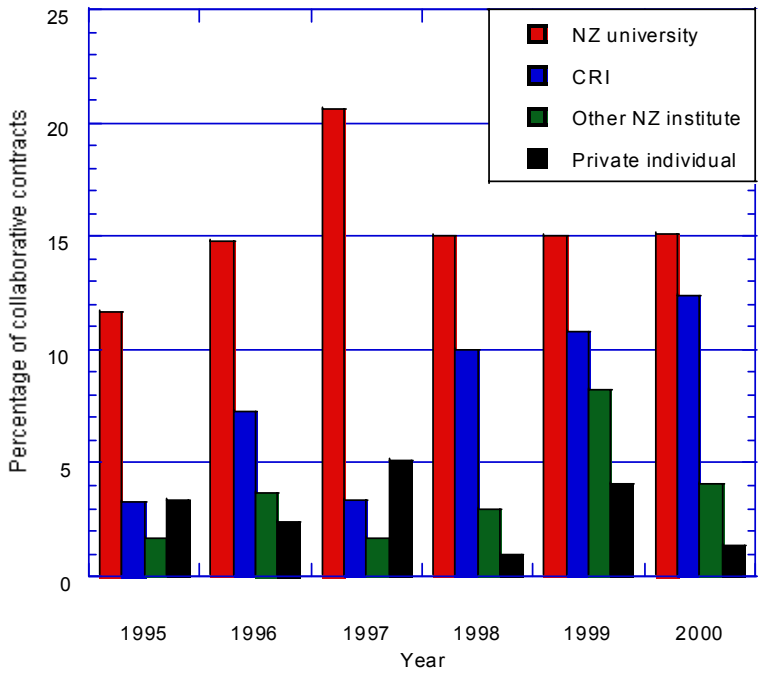

Figure A4: The percentage of contracts for which a principal or associate investigator is in New Zealand and outside the host institution, categorised according to whether the collaborator is from a University, a CRI, any other New Zealand institute, or is a private individual. A particular contract may be represented in more than one category. The main trend is increasing collaboration with CRIs.

4.2 Encouraging multidisciplinary research

There are many examples in Marsden-funded programmes where advances in research span one or more research disciplines, including:

- A study that aims to solve the controversial question as to when New Zealand was first settled; this uses a molecular biology approach to analyse gut bacteria found in ancient sediment cores, as well as vegetation analyses.
- A project that is investigating how larval reef fish can successfully navigate to reefs, sometimes over distances of up to 200 km. The researchers are using a combination of sensory biology and physical techniques such as acoustics to determine the various orientation cues.
- An investigation into the role of bracken root in prehistoric times. The researchers are using an ecophysiological approach to resolve questions regarding the role that bracken root played in Maori settlement.

A more comprehensive list is provided in Table A3. The list excludes the multidisciplinary projects that were listed in the 1999/2000 Strategic Report.

Table A3: Examples of interdisciplinary research in Marsden-funded projects

Marsden researcher (Contract)	**Research disciplines**
Professor J Montgomery (UOA914)	neurobiology, acoustics, behaviour
Assoc. Prof. G Clark (UOA912)	chemistry, molecular biology

Dr J Gerrard (UOC807)	chemistry, biology
Professor R Daniel (UOW001)	physics, enzyme activity
Dr E Parker (MAU008)	molecular biology, organic chemistry
Dr K Gould (UOA019)	chemistry, plant physiology
Dr M McGlone (LCR001)	social sciences, biology
Professor J Flenley (MAU907)	archaeology, palynology, molecular biology (ancient DNA)
Dr M Kelly (NIW901)	paleoecology, phylogeny
Professor D Penny (MAU905)	mathematics, phylogenetics
Dr D Armstrong (MAU003)	mathematics, phylogenetics
Dr H Spencer (UOO916)	mathematics, biology
Dr W Tobin (UOC705)	science, history, biography
Dr S Brown (UOC803)	physics, engineering
Professor H Allen (UOA909)	geography, archaeology
Professor I Craig (UOW606)	mathematics, astrophysics
Professor A Sharp (UOA815)	humanities, social sciences
Assoc. Prof. M Tennant (MAU906)	humanities, social sciences
Professor B Reay (UOA907)	humanities, social sciences

The change in the amount of multidisciplinary research with time can be quantified by using the OECD classification of research fields and shows that the percentage of multidisciplinary contracts has stayed constant at 40-41% in each of the last 4 funding years. This method of measuring multidisciplinary research includes longstanding multidisciplinary groupings such as physics/mathematics or biology/chemistry and this is the likely reason the figure has remained so constant. It is more appropriate to consider novel groupings where the research is breaking new ground, such as those in the bulleted points listed above.

4.3 Promoting a culture supportive of research, science and technology

The Marsden Fund plays a key role in promoting this culture by, for example:

- Publishing a quarterly newsletter highlighting Marsden research.
- Providing press announcements to coincide with the announcement of Marsden funding. This resulted in coverage in at least 18 metropolitan and provincial newspapers throughout New Zealand.
- Organising a function to celebrate and publicise fundamental research. This was held at Parliament Buildings and hosted by the Minister of Research, Science and Technology, Hon. Pete Hodgson.
- Contributing to a diversity of promotional activities, often under the umbrella of the Royal Society. For example, science fairs, Royal Society publications, requests for information from the media, Government departments, school children and research providers, etc.

4.4 Additional Outcomes

- At least 12 Marsden programmes have led to patents or to patents being filed, of which 8 have medical applications and 3 are in new materials or nanotechnology.
- Resources developed by Marsden researchers are used widely by others. Examples include:
  - calibration software for carbon dating now used around the world
  - "DNA Identification Database of Whale and Dolphin Products" available to researchers world-wide for identifying species
- Serendipitous discoveries or happenings occur, as with the following examples:

- The outcome of a researcher planning a visit to a colleague in New York led to a day-long seminar on "Liberal Democracy and Tribal Peoples: Group Rights in Aotearoa/New Zealand", which brought together scholars of the New Zealand diaspora and academics not only from New York, but from Canada also. The Canadian and US academics were so impressed that the bulk of the papers are to be published in the prestigious University of Toronto Law Journal, an important breakthrough for studies of the Maori on the international scholarly scene.
- A group investigating the optimal ways of solving problems on a computer serendipitously discovered a way that quantum computers of the future will be able to find the “very best” solutions. This has opened up a research area not dreamed of when the research programme started.

APPENDIX IV

QUESTIONNAIRE

The following set of questions was sent to the contact person for each contract:

1. Has the Marsden research fed into or changed your other research? If so, please explain how.

2. Has Marsden funding had any long-term effects on the size or capabilities of your group?

3. Has Marsden funding influenced your career or the careers of others on the project?

4. Has Marsden funding led to other funding? Please specify.

5. Has the Marsden funding led to a landmark paper (say, in a prestigious journal, or with a high number of citations – please give number), a patent or a commercial or other spin-off? Please elaborate briefly.

6. Other comments.

APPENDIX V

ANALYSIS OF QUESTIONNAIRE

177 of the 348 principal investigators replied (51%), which we consider to be an excellent response given that no reminders were sent. 162 of the replies were received in time to be analysed for this report. In the following table we have categorised the answers into themes. We have excluded answers to question 5 because they are covered, in part, in Appendix III.

Some points to note when interpreting this table:

- Percentage values indicate the percent of answers in accordance with a particular theme. Some answers were categorised into more than one theme.
- Each question has fewer than 162 "useful" answers because some respondents either did not answer the question, or stated that the question was not applicable to them (often they felt that it was too early in the contract to be able to answer).
- The questions we asked were very general, thus details were volunteered by respondents, not specifically asked for. Therefore, when a particular detail is not volunteered, it may be in some instances because the respondent did not think to mention that point. Thus, while these survey answers provide us with excellent qualitative data on a range of issues relating to Marsden-funded research, only limited quantitative conclusions can be drawn.

Q1. Has the Marsden research fed into or changed your other research? If so, please explain how.	**Useful answers 143**
• Strengthened capabilities for further research	27%
• Changed research direction or led to a new project in a different area	32%
• Changed how they think	11%
• Led to collaborations with other research groups	16%
• Fed into or helped in obtaining funding for commercial ventures or more applied research	23%
• No/not yet/no other projects/projects unrelated	20%
Q2. Has Marsden funding had any long-term effects on the size or capabilities of your group?	Useful answers **127**
• Increased or is anticipated to increase the group's capabilities long-term	59%
• Increased the group's capabilities but this was or is anticipated to be temporary	5%
• Increased or is anticipated to increase the group's size long-term	30%
• Increased the group's size but this was or is anticipated to be temporary	16%
• Raised the prestige or profile of the group	11%
• Increased communication or collaboration with other researchers	28%
• Reduced the size of the group	<1%
• No	9%
Q3. Has Marsden funding influenced your career or the career of others on the project?	Useful answers **139**
• Yes, positive impact (some reasons are below)	90%
– Marsden-funding believed to be a significant factor in the promotion of a researcher who was an AI or PI on the project	14%
– It trained researchers to the point where they then got independent positions leading their own research groups	9%
– It trained researchers to the point where it is anticipated that they will now be able to get interpendent positions leading their own research	6%
– Postdocs/students/research assistants trained on the project have taken up or are	23%

anticipated to get further research positions	
– It was a significant factor in retaining/attracting researchers to New Zealand	8%
– Significant factor in the decision of a researcher to continue their research career	8%
– It enhanced a researcher's standing in the scientific community and/or consolidated their position within their institute	24%
• Negative impact	2%
• No	7%
Q4. Has Marsden funding led to other funding? Please specify.	Useful answers **148**
• Yes (some types of funding specified below)	44%
– NERF	7%
– Other FRST	3%
– HRC	2%
– Internal funds from Institute	9%
– Other New Zealand funding sources	5%
– University and FRST-funded postdoctoral fellowships	4%
– NZ funding for graduate students	4%
– NZ support for conference attendance	1%
– Commercial funding	3%
– Overseas funding for equipment and project expenses	9%
– Overseas funding for postdocs/students	5%
– Overseas funding for conference and travel expenses	5%
– Overseas funding of unspecified type	2%
• No/not yet	56%
Q6. Other comments.	Useful answers **94**
• Positive comments about outcomes of Marsden funding	79%
• Suggest that the Marsden fund be allocated more funding	23%
• Express concern about the fairness of the grant selection process	6%
• Express a belief that the selection process is fair	2%
• Suggest changes to size and duration of grants awarded (categories below)	14%
– Suggest that grants may be awarded for a longer duration than 3 years, or that a system for renewing successful grants be established	11%
– Suggest a larger number of smaller grants be awarded	3%
– Would like less money to be cut from budgets when grants are selected	2%
• Express concern about the commercial focus of the New Zealand funding system	6%

The main findings are as follows:

- The vast majority of respondents stated that their Marsden-funded research had flow-on effects beyond the boundaries of the project funded. These effects included changing the research group's direction (32%), strengthening capabilities for further research (27%), initiation of new research collaborations (16%), and Marsden research feeding into applied research or commercial ventures (23%).
- 59% of respondents stated that Marsden funding either had caused or is anticipated to cause a long-term increase in the research capabilities of their group. In addition, 30% felt that the funding had or would result in a long-term increase in the size of their group. However, a smaller but still significant number expressed the view that Marsden funding had or would

result in only a temporary increase in the size or capabilities of their group, because money is not available to sustain gains once the Marsden contract has finished.

- 90% stated that the Marsden funding had a positive impact on their career or the career of others in the project. Examples of positive impacts include: postdocs subsequently securing independent positions leading their own research groups (9%), promotion of a PI or AI (14%), and postdocs, students and research assistants securing or being anticipated to secure further research employment (23%). Although they were not specifically asked, 8% of respondents stated that the Marsden funding was a significant factor in retaining, or attracting to NZ, a trained researcher.
- Marsden funding is identified as having led to funding from other sources in 44% of the replies. Of particular note are several instances in which it led to funding from overseas agencies, e.g. funding for project expenses and/or equipment (9%), student or postdoctoral stipends (5%), conference and travel expenses (5%).
- Answers to several questions revealed the value placed by researchers on the opportunities that Marsden funding affords for establishing connections and collaborations with other research groups both in and outside of New Zealand. This was identified by 16% of respondents as a way in which Marsden-funding had fed into or changed the group's research, and by 28% of respondents as a factor in increasing the capabilities of the group.
- When asked for "other comments", 79% made positive remarks about outcomes of Marsden-funding, and 23% requested that more money be allocated to the Marsden Fund.
- Also in the "other comments" section, 14% suggested changes to the size or duration of Marsden grants. Of these, 3% wanted a larger number of smaller grants to be awarded and 11% want an option to be established of either renewing successful grants, or awarding some grants for longer time periods.

APPENDIX VI

During 2000/01, there were eleven active James Cook Research Fellowships.

- Dr Ken Mackenzie: Structural studies in advanced ceramic materials—completion date 9/2000 (Physical Sciences—chemistry);
- Professor Brian Boyd: Karl Popper: A life—completion date 10/2000 (Social Sciences);
- Professor Warren Moran FRSNZ: Enterprises and environments in the regulated wine industry—completion date 06/2001 (Social Sciences);
- Professor Peter Hunter FRSNZ: Bioengineering analysis and modelling of heart and lungs—completion date 06/2001 (Engineering Sciences and Technologies);
- Dr Michael Eccles: Strategic targets for cancer therapy and proliferative disorders – completion date 03/2002 (Health Sciences);
- Professor Michael Corballis FRSNZ: Measuring brain activity in human performance—completion date 05/2002 (Biological Sciences);
- Dr Jack Vowles FRSNZ: A Better Democracy? People and politics in New Zealand—completion date 05/2002 (Research of relevance to the Peoples' of New Zealand and the South West Pacific).
- Professor Graham Le Gros (Health Sciences): Biology of asthma and the search for new therapies—completion date 30 April 2003;
- Professor Gavin Martin FRSNZ, (Physical Sciences): Nonlinear analysis and geometry—completion date 30 April 2003;
- Professor Josu Arrillaga FRSNZ (Engineering and Technologies Sciences): Modelling of power systems under power electronic control—completion date 30 April 2003.
- Professor Judith Binney CNZM FRSNZ: A History of the Urewera, 1829–1922—completion date 04/2003 (Social Sciences);

APPENDIX VII

Management of the Promotion of Science and Technology

Auckland Festival of Science and Technology

"Bump Into" science and technology was the theme for the Auckland Festival of Science and Technology, held from June 30 to July 6 in venues all over the Greater Auckland area. It involved 42 different organisations who contributed 373 mostly free individual events over the seven days. Science programmes were staged at Kelly Tarltons, the Maritime Museum, Stardome Observatory, Auckland Museum and Motat. Each university held an open day which were well attended. Auckland University's Science Faculty coped with crowds of people turning up from 8am, and had to put on extra shows. The attraction of Dr Bunhead from the Edinburgh Science Festival ensured record crowds at Massey University's campus in Albany. Adding to the "Bump Into" theme was the involvement of the six Westfield Shoppingtowns, where 3 science shows a day in each mall attracted an average of 150 people per show. Post-Festival survey figures indicate that close to 96,000 people participated directly in the Festival, with a total level of exposure being over 344,000 people. Almost 85% of participants who responded to a questionnaire said that their interest in science and technology had increased as a result of the Festival. Forty-two organisations took part, staging 373 events over the 7 days. The Royal Society contracted Caroline Cook, who is based in Dunedin, to organise the Festival, drawing on experience gained from the very successful biennial New Zealand International Science Festival in Dunedin.

The report prepared by the organisers has been placed on the Royal Society website.

Role Models Programme

A pilot workshop was held in Auckland in February to train 20 people with backgrounds as diverse as engineering, paleontology and environmental law. The 4 day workshop was held at the Stardome Observatory, AUT and Auckland Museum, in order to observe how each institution communicated science to their respective audiences. The programme comprised sessions with media, including newspaper journalists, radio and television experts. Over the 4 days each participant developed a short science show suitable for a general audience. These were videoed and they formed the basis on which five people were offered the chance to work closely with the Auckland Festival's organisers and with another programme run by the Auckland Branch of the RSNZ.

A database has been compiled containing the details of over 50 scientists and technologists who are skilled at communicating with general audiences. The details include topic preferences and preferred audiences. This database has been shared with the Event Co-ordinator of the Knowledge Wave in Auckland. Several other organisations are currently using this resource, including Te Papa who are often looking for speakers for their programmes.

This programme has received widespread support from the RS&T community, with organisations approached being very enthusiastic. Some have indicated a desire to join their own programmes, or have suggested ways to co-operate. All have been keen to give names of potential role models and to be kept appraised of progress. This is in keeping with the goal of the programme to augment and enlarge what is there, rather than replace.

Research Reports

The research report commissioned with the Department of Plant and Microbial Sciences, University of Canterbury was completed satisfactorily. It includes an analysis of how many journalists and major media organisations are reporting on science, how much time they spend on science versus other topics and how their organisation treats science news. It also includes research to determine whether New Zealanders feel differently about scientists and science theories when journalists present validity assessments than when such context is absent. The report found that whilst there was a fair quantity of science coverage in the media, the treatment of some science issues was superficial. The results will be presented at the Science Communicators Network Workshop in November 2001.

The second is with Landcare Research and is to look at ways to engage the public in understanding complex science information. Research included talking to rural communities about the many complex requirements for sustainable development. To complete his contract Will Allen will conduct a workshop in Wellington in October.

Wow! its science website

This website is updated weekly with new articles, links and interviews. It is now a significant resource of fascinating and interesting websites from New Zealand and throughout the world, which promote science and technology. Research shows that 50%of the site visitors are from outside New Zealand.

APPENDIX VIII

Contestable Fund - 2000/01 Recipients

The following projects received funding from the 2000/01 funding round

Up to $100,000 (including GST)

National Science-Technology Roadshow Trust (2 years)
'Ingenious Kiwis' will be a touring multimedia exhibition showcasing the achievements and ingenuity of New Zealanders. It will tell the story of how they identified problems, explored possible solutions and then went on to develop new concepts or products, many of which have gone on to be commercial successes. The scientific and technological principles on which these solutions were developed will be presented in an interactive format. Real objects and products will be featured which will be recognised by visitors. They will then be able to identify the links between the products and the role of the science and technology sector.

A family-oriented education resource and an interactive website will support this exhibition which will tour over 20 towns and cities, attending major community events such as A&P Shows.

Present status: *The Roadshow Trust has made a successful bid to the Lotteries Commission for a trailer to house and transport the exhibition. Sponsorship applications are still underway and the latest schedule for delivery is November 2002.*

Up to $30,000 (including GST)

New Zealand Ecological Society
'Tui Time' will be an interactive CD-Rom that will be distributed free to all primary schools in New Zealand. Tiaki Tui will lead children through three fun activities that are linked to an "encyclopedia" of ecological information and pictures. Part of the CD-Rom will be presented both in Te Reo Maori and English. The CD-Rom will deal with adaptations of various native bird species, have an interactive activity about a day in the life of a tui, and include stories about the tui from kuia, scientists and children.

Present status:
A prototype CD-Rom has been tested and the project is scheduled for completion in November 2001

Lincoln University
This project involves establishing 'biodiversity farm trails' in Canterbury and East Cape. The trails are designed to explain and promote the usefulness of biodiversity on cropping land. The trails will include information booths, demonstration sites showing a range of native and non-native biodiversity improvements, and information signs on the farm walks. The trails will be oriented to the rural community in particular.

Present status:
This 18-month project will draw to a close at the end of the calendar year. A video, website and information leaflets for the booths are being produced. Several workshops have taken place at the Lincoln site, and a major field day was held at Gisborne, which has led to media interest.

University of Canterbury
This programme will see the development of a series of presentations by PhD. students on topical issues, which will be delivered to Year 11 school students. The presenters will be selected for their potential to communicate effectively. Their presentations will encourage an appreciation of the pivotal place that science holds in modern society, describe how scientific research can help solve some of the really big problems in our modern world, and to demonstrate to young people that study of science at tertiary level is rewarding and worthwhile.

Present status:
Project completed. Thirty-five graduate students attended a training workshop in February 2001. A total of 122 presentations were given at 29 schools, reaching ca. 2800 students around the central and northern South Island, with 80 extra presentations planned for the month of July. These talks ranged in topic from "Savage Earth" to "Is eating a dangerous occupation?"

Auckland War Memorial Museum (2 years)
'Living Treasures in Science' will involve developing and implementing a programme of presentations, demonstrations and displays at Auckland Museum, using invited researchers to discuss their particular area of expertise. By using 'real' researchers the public will feel they are being informed on a direct level and from a unique source, and the Museum will be able to tap into the infectious enthusiasm of researchers.

Present status:
This two-year project commenced in December 2000 and has thus far resulted in the completion of four projects of varying duration and differing methods of communication. "Seeing Red" was a display, lecture and field trip on the Pohutukawa, in conjunction with Project Crimson. A demonstration on lichens and a field trip to the Hunua Ranges were also held. Dinosaur Day proved to be extremely popular, with the guest appearance of Joan Wiffen, NZ's own Dinosaur Lady.

The Auckland Observatory and Planetarium Trust
Based on the explosion of a large meteor over Taranaki in July 1999 'Aotearoa Armageddon' will allow the public to explore this event by using an interactive multimedia production, similar in nature to an "adventure game". The audience will take on the role of scientists, using the multimedia database to identify the Taranaki object. The game will be programmed in such a way that there are branch points where the audience needs to make knowledge-based decisions in order to proceed, with that knowledge being supplied via videos, slide and sound media.

Present status:
Progress on this project has been delayed due to the departure of the applicant. However, the production is on line for a debut in December 2001.

***Science Alive!* The New Zealand Science Centre**
'SciTech on the Move' is an integrated science and technology programme, involving stand-alone modular interactives, activities and shows. This programme will be designed to be set up in shopping malls and presented to the general public. Each of the eight interactives will present a simple science and technology principle. The four themes covered will be lifestyle, communications, the body, and forces.

Present status:
This programme was one of the exhibits at the Auckland Festival of Science and Technology and has so far proved to be well received at venues across the country. By its completion in December 2001, the exhibition will have visited at least 20 shopping malls, fairs and rural shows.

Discovery World, Otago Museum
'Amusing Science' is a 15-minute interactive science and technology show that will take place at venues such as school fairs, quiz nights and community events, which attract parents and grandparents. By presenting the science message in a positive, exciting and interactive way, audiences will see the relevance of science and technology to everyday life.

Present status:
Project completed. Eighty shows were presented within Otago, travelling as far as the Catlins and Roxburgh. The standard was high, and 4467 people were reached with the message that science is part of our everyday lives. Questionnaire responses were excellent.

Rutherford's Den Trust Board
This project is to create an innovative and unique set of visitor experiences centred on the authentic site of Rutherford's Den. The Den is the original space within the Arts Centre in which Rutherford undertook his early experimental research at Canterbury College. As part of the new visitor experience it is planned to create a virtual presentation of Rutherford "live", interacting with visitors in his original setting, using very special effects.

Present status:
Significant additional funding has been gained to ensure the Visitor Centre at Rutherford's Den will be a very high quality experience. Storyboards and multi-media experiences are underway, and the project is due for completion in August 2001.

The National Science-Technology Roadshow Trust
'Street Shows' will be a series of science and technology-based shows for people on the streets of metropolitan Auckland. The street shows will be entertaining in a way which will "stop the traffic" and hold interest, be informative, and link science and technology phenomena to our everyday world.

Present status:
A series of shows were performed in the Auckland area, as part of the Auckland Festival of Science and Technology and continuing after the Festival. The script includes principles of pressure leading to fluid (air and liquid) pressure phenomenon.

Victoria University of Wellington
'Imaging the Earth' is a hands-on outdoor road show that will include an interactive slide presentation and the opportunity for students to operate equipment that will enable them to image the earth under their school. This experience will be followed up by an evening lecture for parents and other community members demonstrating the geophysics experiments their children were engaged in during the day.

Present status:
This project has been delayed with the departure of several staff. A new project leader has been contracted and a pilot program involving a local school will be completed by September. The final project will end early in 2002.

The Waikato Polytechnic and the Exscite Trust

'Techno-Fest' is to be a Waikato-based festival celebrating technology. It will emphasise the links between science, technology and a range of industries and activities in the community. It will demonstrate the links between science, technology and the arts and will give insights into employment and community activities.

Present status:
Project completed. This proved to be a very successful festival, with well-attended industry visits. Links between culture and Science and Technology were fostered at a 'Technofunday' held at the Welltrust Academy of Performing Arts. This attracted between 3000 and 4000 people who would not normally have attended a traditional science festival.

APPENDIX IX

During the reporting period the following meetings and symposia have also received some financial assistance from the Society:

- 10th International Symposium of Acoustic Remote Sensing in Auckland
- International Ribosome Synthesis Meeting in Queenstown
- ANZCCART/NAEAC Conference in Hamilton
- 2nd International Workshop on Edible Mycorrhizal Mushrooms in Dunedin
- Ten Years of Paleoseismology in the ILP Meeting in Kaikoura
- 21st International Carbohydrate Symposium to be held in Cairns, Australia in 2002

APPENDIX X

The following have been provided with limited financial assistance to attend their respective General Assembly's or International Congresses:

- Dr Clive Howard-Williams, NIWA attended the Scientific Committee on Antarctic Research (SCAR) General Assembly in Tokyo, Japan in July 2000;
- Dr Tom Wheeler, AgResearch attended the International Union of Biochemistry and Molecular Biology (IUBMB) International Congress in Birmingham, United Kingdom in July 2000;
- Prof. John Hearnshaw, University of Canterbury attended the International Astronomical Union (IUA) General Assembly in Manchester, United Kingdom in August 2000;
- Dr Ian Smith, University of Otago and Dr Ian Speden Institute of Geological and Nuclear Sciences attended the International Union of Geological Sciences (IUGS) International Congress in Rio de Janeiro, Brazil in August 2000;
- Prof. Richard Bedford, University of Waikato and Prof. Warren Moran, University of Auckland attended the International Geographical Union (IGU) International Congress in Seoul, Korea in August 2000;
- Prof. Jeremy Astley, University of Canterbury attended the International Union of Theoretical and Applied Mechanics (IUTAM) General Assembly in Chicago, USA in September 2000;
- Dr Jill Stanley, HortResearch attended the International Society for Horticultural Science (ISHS) General Assembly in Cairo, Egypt in October 2000;
- Dr Julie Hall, NIWA attended the Scientific Committee on Oceanic Research (SCOR) General Meeting in Washington, USA in October 2000;
- Dr John Clare, Industrial Research Ltd attended the World Congress of Physical Societies in Berlin, Germany in December 2000;
- Dr Andrew Laing, attended the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) in Iceland in June 2001.

APPENDIX XI

International visitors to the Royal Society during 2000/01 included:

- Dr Alice Hogan, Senior Program Manager, Asia Pacific Programs, National Science Foundation (NSF) Division of International Programs, National Science Fund, USA;
- Professor Michael Kelly FRS FREng., Department of Electronic Engineering, Information Technology and Mathematics, University of Surrey, United Kingdom. 2000 Rutherford Memorial Lecturer;
- Delegation from Ministry of S&T, China – Mr Du Zhanyuan, Head of Delegation, Department of Development Planning and accompanied Mr Huang Wei, Department of Development Planning, Mr Chang Hailin, Department of International Co-operation; Professor Tang Shiguo, National Research Center for Science and Technology for Development.
- Dr Ruben L Villareal, Director, SEARCA, SEAMEO Regional Center for Graduate Study and Research in Agriculture, Laguna, Philippines accompanied by Dr Gil Saguiguit
- Professor Dr U R Sangakkara, Faculty of Agriculture, University of Peradeniya, Peradeniya 20400, Sri Lanka
- Professor Neil Ashcroft Hon FRSNZ, Cornell University, USA
- Claire Curtis-Thomas, MP, Crosby, Liverpool, United Kingdom
- Dr Jack Sommer, Knight Distinguished Professor, University of North Carolina at Charlotte, USA
- Professor Hans Weldt from the German Deutsche Forschungsgemeinschaft, Germany
- Mr Chen Mingming, Ambassador Peoples' Republic of China
- Mr Feng Xuan, First Secretary Science & Technology, Embassy of Peoples' Republic of China
- Professor Alan MacDiarmid, Nobel Laureate and Rutherford Medal winner
- Dr Tom Pringle, Science Communicator, United Kingdom