

The New Zealand Institute
of Mathematics & its Applications
(NZIMA)

ANNUAL REPORT
for the year 1 July 2002 to 30 June 2003

Approved by NZIMA Governing Board
on 31 October 2003

1. Introduction: History, Aims and Activities of the NZIMA

The New Zealand Institute of Mathematics and its Applications (NZIMA) was established in 2002 as one of the five Centres of Research Excellence selected by the New Zealand government in March 2002. It is hosted at the University of Auckland and headed by Fields Medallist and Distinguished Alumni Professor Vaughan Jones *DCNZM DSc FRS FRSNZ* (Berkeley) and Professor Marston Conder *DSc FRSNZ* (Auckland), with involvement of many of the best pure and applied mathematicians and statisticians from across the country.

The principal aims of the NZIMA are to

- create and sustain a critical mass of researchers in concentrations of excellence in mathematics and statistics and their applications
- provide NZ with a source of high-level quantitative expertise across a range of areas
- facilitate access to new developments internationally in the mathematical sciences, and
- raise the level of knowledge and skills in the mathematical sciences in N.Z.

It is modelled on similar mathematical research institutes in other countries, notably the Fields Institute (Canada), MSRI (Berkeley), and the Newton Institute (UK). In particular, it places considerable emphasis on world-class research in fundamental areas of the mathematical sciences and the use of high-level mathematical techniques in modern application areas such as bioengineering, bioinformatics, medical statistics, operations research, and risk assessment.

Its key activities include

- the organisation of 6-monthly programmes on themes drawn from a range of fields of significant interest
- associated workshops held at various locations around NZ
- establishment of postdoctoral fellowships in the theme areas
- establishment of PhD and/or Masters degree postgraduate scholarships in the theme areas
- establishment of a small number of merit-based open scholarships for research students (from New Zealand or worldwide) in unrestricted areas of the mathematical sciences
- establishment of annual Maclaurin Fellowships (*), to enable mathematical scientists from NZ or worldwide to take time out from their usual occupations and undertake full-time research in New Zealand (or partly overseas if based in New Zealand).

(* Richard Cockburn Maclaurin was a graduate of Auckland University College who went on to study at Cambridge, where he won the Smith Prize in Mathematics and Yorke Prize in Law, and was appointed as Foundation Professor of Mathematics at Victoria University College in 1899, and later Dean of Law and Professor of Astronomy. In 1908 he was invited to become President of the Massachusetts Institute of Technology (MIT), and helped transform that institution into the world-class research-based technological university it is today.)

The NZIMA was formally established in June 2002 as a partnership between the University of Auckland (its host) and the N.Z. Mathematics Research Institute (NZMRI). The NZMRI is an incorporated society, which for the last ten years has organised summer meetings in New Zealand on particular topics of contemporary significance in mathematics, with support from the Marsden Fund and contributions by individuals (from N.Z. and overseas) and by mathematics and statistics departments at N.Z. universities. The NZIMA is building on this activity.

2. NZIMA Governance and Management

2.1 Governing Board

The NZIMA is overseen by a *Governing Board*, with seven members appointed by each of the University of Auckland and its partner organisation the NZMRI (Inc.), and has an independent chairperson. The Governing Board's responsibilities are to oversee the Institute's activities and finances and ensure that it is meeting its responsibilities under the terms of the joint venture agreement and those of the Centres of Research Excellence Fund.

In particular, the Governing Board will help formulate the research strategy of the NZIMA, the method by which its research programmes and projects are developed, and the strategy and responsibility for the recruitment, education and ongoing development of students and other new researchers. The Governing Board also has responsibility for appointing an International Scientific Advisory Board (see 2.2 below) and an Executive Committee (see 2.3 below), approving annual budgets and financial accounts prepared by the Co-Directors and the Executive Committee, and ratifying contracts and fellowships that are let by the NZIMA. The Governing Board is to meet at least twice yearly, in person or by audio-conference.

The current membership of the NZIMA Governing Board is as follows:

Chair of Board

- Sir Ian Axford *DSc FRS FRSNZ*

Members appointed by the University of Auckland:

- Professor Philippa Black (University of Auckland)
- Emeritus Prof. John Butcher (University of Auckland)
- Prof. Peter Hunter (University of Auckland)
- Dr John Kernohan (Auckland UniServices Ltd)
- Prof. David Ryan (University of Auckland)
- Prof. Alastair Scott (University of Auckland)
- Prof. James Sneyd (University of Auckland)

Members appointed by the NZMRI (Inc.):

- Prof. Rod Downey (Victoria University of Wellington)
- Prof. Mike Hendy (Massey University)
- Prof. Gaven Martin (University of Auckland)
- Prof. Mike O'Sullivan (University of Auckland)
- Prof. Andy Philpott (University of Auckland)
- Emeritus Prof. David Vere-Jones (Statistical Research Associates)
- Dr Graham Weir (Industrial Research Ltd).

Co-Directors (ex officio):

- Prof. Marston Conder (University of Auckland)
- Prof. Vaughan Jones (University of Auckland and University of California Berkeley).

2.2 International Scientific Advisory Board

The NZIMA seeks advice and guidance on its research programmes from an *International Scientific Advisory Board*, which is made up of prominent New Zealand mathematical scientists resident overseas, representatives from similar organisations (such as the CMA, MSRI and Fields Institute), and other notable individuals with a positive record of contact with the New Zealand mathematical sciences community. The composition of this advisory board is arranged to ensure balanced representation across the various disciplines of the mathematical sciences.

Members of the International Scientific Advisory Board are invited to review proposals for NZIMA programmes and applications or nominations for Maclaurin Fellowships, and to recommend new themes, suitable visitors and workshop speakers. This advisory board will meet virtually, by electronic mail, however the NZIMA plans to invite one of two members each year to visit New Zealand and take part in some of the NZIMA's activities.

The current members of the NZIMA's International Scientific Advisory Board are as follows:

- Prof. Andreas Dress (Universität Bielefeld)
- Prof. Peter Hall (CMA, Mathematical Sciences Institute, Australian National University)
- Prof. Gus Lehrer (University of Sydney)
- Prof. Jerrold Marsden (California Institute of Technology)
- Prof. Cheryl Praeger (University of Western Australia)
- Prof. Dale Rolfsen (University of British Columbia)
- Prof. Mike Saunders (Stanford University)
- Prof. Michael Singer (Mathematical Sciences Research Institute, Berkeley, California)
- Prof. Bruce Weir (North Carolina State University)
- Prof. Keith Worsley (McGill University, Montreal)
- Prof. Margaret Wright (Courant Institute, New York University).

2.3 Co-Directors and Executive Committee

Management of the NZIMA's activities is the responsibility of the two *Co-Directors* and an *Executive Committee* appointed by the Governing Board. The Co-Directors and Executive Committee have delegated authority to manage the affairs of the NZIMA in accordance with the policy of the Governing Board.

The main responsibilities of the two *Co-Directors* are to:

- recommend policy to the Governing Board
- carry out the directions of the Governing Board
- convene meetings and discussions of the Executive Committee and other sub-committees
- maintain financial oversight of activities, staffing, and resources
- coordinate administrative matters with the host and partner organisations (the University of Auckland and the NZMRI), the CoRE Fund administrators, and other funding agencies
- coordinate collaboration with other organisations involved in research in the mathematical sciences in New Zealand (such as the NZ Mathematical Society (NZMS), the NZ Statistics Association (NZSA), the Operations Research Society of NZ (ORSNZ), and the NZ branch of Australia & New Zealand Applied Mathematics (ANZIAM))

- maintain and further promote linkages with other mathematical research institutes overseas.

The Executive Committee consists of the two Co-Directors (ex officio) plus three other members (each appointed for a 2-year term), with assistance from an Executive Administrator. Appointments to the Executive Committee will be on a rotating basis, with the aim of ensuring balanced representation both in terms of pure/applied focus and affiliation.

The main responsibilities of the Executive Committee are to assist the Co-Directors in:

- developing policy for and carrying out the directions of the Governing Board
- selecting (preliminary) proposals for NZIMA programmes to be developed into full proposals for consideration by the Governing Board
- selecting candidates for Maclaurin Fellowships, postdoctoral fellowships, student scholarships, and other activities for NZIMA support
- appointing programme directors and committees
- setting programme budgets and reviewing reports if required.

The *Executive Committee* considers such matters in consultation with the two Co-Directors on a regular basis, either in person, or by electronic mail, or by audio-conference.

The current members of the NZIMA Executive Committee are as follows:

- Professor Marston Conder (Co-Director, ex officio)
- Professor Vaughan Jones (Co-Director, ex officio)
- Prof. Rod Downey (Victoria University of Wellington)
- Prof. David Ryan (University of Auckland)
- Dr Graham Weir (Industrial Research Ltd).

2.4 Programme Committees and Programme Directors

All special thematic programmes run by the NZIMA are organised by *Programme Committees*, each convened by a Programme Director.

Each Programme Committee is charged with the responsibility of organising the programme (or theme) as approved by the Governing Board, and includes the Programme Director plus at least one member appointed by the NZIMA Executive Committee. The main responsibility of the programme committee is the organisation of the programme, including conferences/workshops, and selection and appointment of visiting experts, postdoctoral fellow and postgraduate scholars.

Each Programme Director is expected to provide written interim and final reports through the Executive Committee to the Governing Board, on both scientific activity and financial arrangements. These reports include a final financial statement for the entire programme, a list of all persons involved, and a list of scientific publications and other research outputs resulting from the programme.

2.5 Executive Administrator

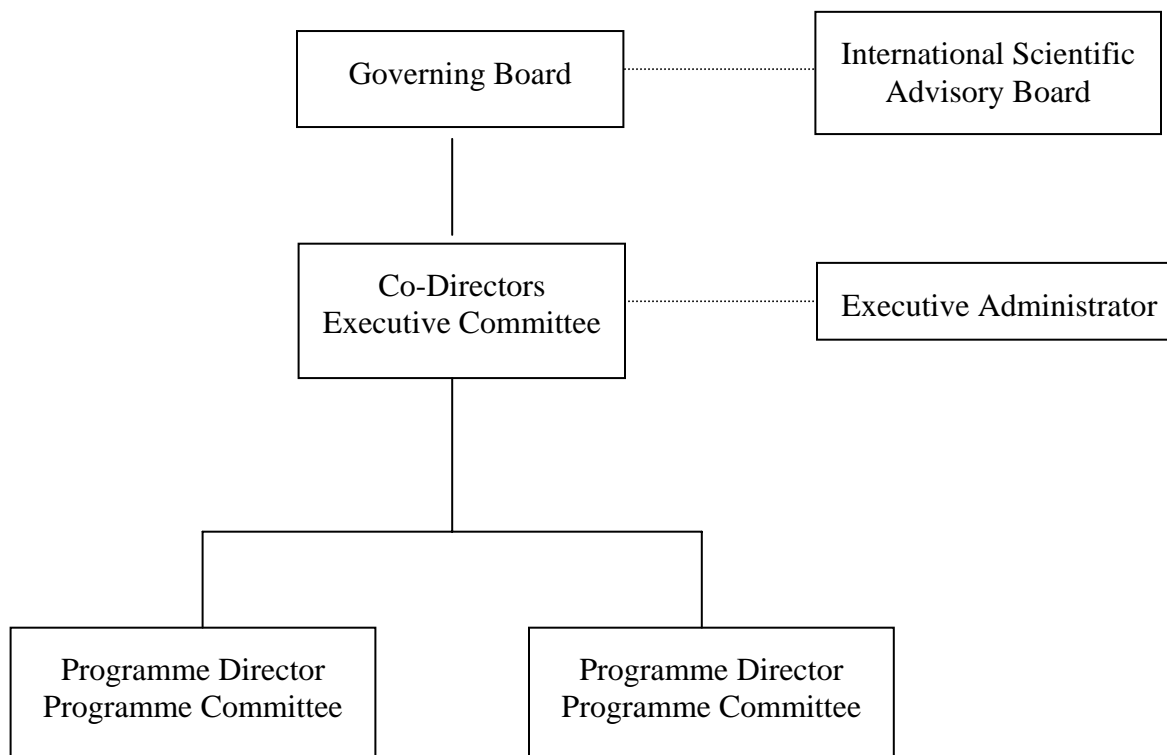
The main responsibilities of the *Executive Administrator* are to:

- provide HR, financial and other administrative assistance to the Executive Committee and Co-Directors

- help coordinate workshop and conference organisation for each programme committee
- liaise with Programme Directors, Maclaurin Fellows and scholarship holders
- maintain correspondence for the NZIMA
- prepare and disburse publicity material on the activities and outputs of the NZIMA.

The Executive Administrator is Margaret Woolgrove (University of Auckland).

2.6 Organisational Chart



2.5 Host and partner arrangements

Office accommodation are provided by the host organisation (the University of Auckland) for the NZIMA Co-Directors and Executive Administrator, along with support services for administrative functions, including human resource and financial accounting services. The costs of these are covered from overhead funding in the NZIMA's CoRE Fund budget. A partnership agreement between the host organisation and the partner organisation (the NZMRI) has been negotiated to ensure appropriate division of responsibilities, revenue and expenses (including allocation of overheads).

Arrangements are made for subcontracting services (including programmes and Maclaurin Fellowships as necessary) through the University of Auckland's Research Office. Arrangements will be made as necessary for commercialisation of NZIMA-funded research and protection of intellectual property through Auckland UniServices Ltd, which has a wealth of experience and a track record of success in this area.

3. Board member and Director profiles

3.1 Chair of the NZIMA Governing Board

Sir Ian Axford *DSc FRS FRSNZ* is a distinguished scientist who recently retired from his position as Director of the Max-Planck Institute für Aeronomie in Germany. He was named New Zealander of the Year in 1995, in recognition of his distinguished international career in the field of space science. His work placed him at the forefront of near-Earth and Solar System research. He was closely involved with the Voyager 1 and Voyager 2 planetary explorers, the Giotto space-probe, and the Ulysses galaxy explorer. He has made a lifelong commitment to excellence in research and also to the growth and popularisation of science. He previously held positions as a professor at Cornell University (New York) and at the University of California at San Diego, Vice-Chancellor of Victoria University of Wellington, and Chair of the Marsden Fund. He is a Fellow of the Royal Society of London and an Honorary Fellow of the Royal Society of New Zealand, and has an Honorary Doctorate from Victoria University of Wellington.

3.2 Governing Board Members

Philippa Black FMSAm FRSNZ is a Professor of Geology at the University of Auckland, and is also acting as an associate Deputy Vice-Chancellor (Research). She was formerly President of the Royal Society of New Zealand, and also formerly chair of the University of Auckland's Postgraduate & Scholarships Committee. She has considerable experience and wisdom in dealing with academic and research matters.

John Butcher DSc FRSNZ is an Honorary Research Professor of Mathematics at the University of Auckland, having previously been Head of the Applied and Computational Mathematics Unit, Head of the Computer Science Department, and Head of the Mathematics Department during his distinguished career. He is a world authority on the numerical solution of ordinary differential equations, won the NZ Mathematical Society's annual Research Award in 1991, and won the Hector Medal (of the Royal Society of NZ) in 1996.

Rod Downey FRSNZ has a personal chair in Mathematics at Victoria University of Wellington, is one of the five (unpaid) directors of the NZMRI, and was President of the NZ Mathematical Society for the last two years. He won the Hamilton Award of the Royal Society of NZ in 1990, the NZ Mathematical Society's annual Research Award for 1992, the NZ Association of Scientists' Research Medal in 1994, and has won numerous other awards for his work in logic and computational complexity.

Michael Hendy FICA FRSNZ holds a personal chair in Mathematical Biology at Massey University, and is Co-Director (with David Penny) of the Allan Wilson Centre (one of the other Centres of Research Excellence in NZ). He has been Head of the Mathematics discipline group in the Institute of Fundamental Sciences at Massey University and Assistant Editor of the journal *Molecular Biology and Evolution*.

Peter Hunter FRSNZ is a Distinguished Professor at the University of Auckland, and is Director of its Bioengineering Institute. He was awarded a James Cook Fellowship in 1991, and was elected a Fellow of the American Institute for Medical and Biological Engineering in 2001. He has also been Chair of the Physiome Commission of the International Union of Physiological Sciences and a member of the Scientific Advisory Board of Physiome Sciences Ltd.

John Kernohan is Chief Executive Officer of Auckland UniServices Ltd, which is responsible for commercial research and consultancy partnerships, forming new business ventures based on University research, and developing intellectual property. With a PhD in Chemistry, he spent some years in R&D management for General Electric and as CEO of several businesses for ICI New Zealand Ltd. He was appointed UniServices' founding CEO in 1988, and has helped it grow from small beginnings to a significant entity with annual revenue exceeding \$60m pa.

Gaven Martin FRSNZ has a personal chair in Mathematics at the University of Auckland, is one of the five (unpaid) directors of the NZMRI, and also currently holds a James Cook Fellowship. He won the NZ Mathematical Society's annual Research Award for 1994, and has also won several other prestigious awards, prizes, fellowships and visiting positions overseas. He is joint author of a recent book *Geometric function theory and non-linear analysis* published by Oxford University Press.

Mike O'Sullivan FIPENZ has a personal chair in Engineering Science at the University of Auckland, and is currently also Head of Department of Engineering Science. His speciality is mathematical and computational modelling of geothermal fields, and has been involved as a consultant for over 20 geothermal projects in Indonesia, Japan, Kenya, New Zealand, USA and Mexico. He is Associate Editor of the journal *Geothermics*, and has supervised over 40 postgraduate research students at Masters and PhD level.

Andy Philpott has a personal chair in Engineering Science at the University of Auckland, and is currently chair of the Royal Society of New Zealand's Standing Committee for Mathematical and Information Sciences. His research interests are in discrete optimisation, operations research and mathematical modelling.

David Ryan FIMA FIPENZ is a Professor of Operations Research at the University of Auckland, and is former Head of its Department of Engineering Science. He is well known internationally for his work on developing methods for solution of large-scale linear programming problems, especially in the context of scheduling. He won the Engineering Excellence Award in Information Technology from the Institution of Professional Engineers New Zealand (IPENZ) in 1999, and won the Hans Daellenbach Prize of the Operations Research Society of NZ in 2001.

Alastair Scott FASA FIMS FRSNZ FRSS has a personal chair in Statistics at the University of Auckland, and was previously Head of the Departments of Mathematics and Statistics. He has a worldwide reputation for his research on sample survey statistics, and has been appointed to many editorships, fellowships of professional societies, and visiting positions at universities and laboratories overseas. His expertise has also been recognised by appointments to government and professional bodies (such as the NZ Environmental Risk Management Authority).

James Sneyd is Professor of Applied Mathematics and Head of the Applied Maths Unit at the University of Auckland. He is best known for his work in physiological modelling, and was joint winner of the American Association of Publishers' Award in 1998 for Best New Title in Mathematics, for his book *Mathematical Physiology* (co-authored with J. Keener). He is also closely involved with programmes at the Mathematical Biosciences Institute (in Ohio).

David Vere-Jones FRSS FRSNZ is an Emeritus Professor at Victoria University of Wellington, and a director of Statistical Research Associates (a private consultancy firm). He specialises in mathematical and statistical modelling, with particular interests in geophysics and in statistics education. He won the International Statistical Institute's Henri Willem Methorst Medal in

1995, and the Royal Society of New Zealand's Rutherford Medal in 1999, and has won a significant number of other grants and awards and distinctions.

Graham Weir DSc FRSNZ is leader of the Applied Mathematics group at Industrial Research Ltd, and is currently chair of the NZ Branch of the professional organisation ANZIAM (Australia and New Zealand Applied Mathematics). He specialises in the mathematical modelling of physical systems. He won a Ministerial Award for Excellence in Science in 1987, a Royal Society of NZ Science and Technology Medal in 1996, and the NZ Mathematical Society's annual Research Award for 2000. He has also served on several key committees.

3.3 Co-Directors

Marston Conder DSc FRSNZ is a Professor of Mathematics at the University of Auckland, best known for his work on the application of combinatorial and computational group theory to the analysis and construction of discrete objects with maximum symmetry. He obtained his doctorate from the University of Oxford, where he won the Senior Mathematical Prize and Johnson Prize in 1980. He held a postdoctoral fellowship at the University of Otago in 1981, followed by a Royal Society (UK) Research Fellowship at the University of Tübingen (Germany) in 1982, and a Fellowship from the Alexander von Humboldt Foundation in 1987. He won the NZ Mathematical Society's annual Research Award for 1993, was elected a Fellow of the Royal Society of NZ in 1998, and awarded a DSc by the University of Oxford in 1999.

He was President of the NZ Mathematical Society from 1993 to 1995, co-founder and initial convenor of the NZ Mathematical and Information Sciences Council (now a standing committee of the RSNZ) in 1994, and is a co-founding Director of the NZMRI (Inc.). He participated as a lead expert in the MoRST Review of New Zealand's Scientific Knowledge Base in 1996, was a member of the TEAC Research Working Group (2000–2001), and in 2002 chaired the NZ Ministry of Education's Working Group that developed recommendations for a Performance Based Research Fund (PBRF) for tertiary education institutions in NZ. At the University of Auckland he was Head of the Department of Mathematics from 1996 to 1998, and served a term as Deputy Vice-Chancellor (Research) from 1999 to 2001. He is a member of the Editorial Board of the NZ Journal of Mathematics, and a member of the Marsden Fund Council (and convenor of its Mathematical & Information Sciences panel).

Vaughan Jones DCNZM DSc FRS FRSNZ is a Professor of Mathematics at the University of California at Berkeley and Distinguished Alumni Professor of the University of Auckland. After obtaining a Masters degree with first class honours at Auckland in 1973, he won a Swiss Government Scholarship and an FWW Rhodes Memorial Scholarship to study for a doctorate at the University of Geneva. In 1979 he was awarded the degree of *Docteurs Sciences (Mathématique)*, and the following year the Vacheron Constantin Prize for his doctoral thesis. He held postdoctoral positions at the University of California at Los Angeles (UCLA) and the University of Pennsylvania. During the 1980s his research focussed on von Neumann algebras, and in the course of this work he discovered a new polynomial invariant for knots which led to surprising connections between apparently quite different areas of mathematics.

He was awarded a Fields Medal at the 1990 International Congress in Kyoto (Japan) for his remarkable and beautiful mathematical achievements, and he is believed to be the only person from Australia or New Zealand ever to have won this prestigious award. Since then he has gone

on to receive numerous awards and honours, including a Guggenheim Fellowship in 1986, Fellowship of the Royal Society (of London) in 1990, the Rutherford Medal in 1991, honorary doctorates from the University of Auckland in 1992 and the University of Wales in 1993, membership of the US National Academy of Sciences in 1999, the Onsager medal of Trondheim University (Norway) in 2000, foreign membership of the Norwegian Royal Society of Letters and Sciences 2001, and a Distinguished Companionship of the Order of New Zealand in 2002.

He has been invited to lecture at numerous international congresses, and has served as editor or associate editor of many top international journals, including the *Transactions of the American Mathematical Society*, *Reviews in Mathematical Physics*, and the *Journal of Mathematical Chemistry*. Also he has been a member of the Scientific Advisory Boards of the Fields Institute for Mathematics (Canada), the Erwin Schrödinger Institute for Mathematical Physics (Vienna, Austria), the Mathematical Sciences Research Institute (USA), the Center for Communications Research (USA), and the Institut Henri Poincaré (Paris, France).

He is founder and principal director of the NZMRI, a role in which he has been instrumental in attracting some of the world's best mathematicians to NZ. His own style of working is informal, encouraging the free and open interchange of ideas, and this has rubbed off on many others. His efforts have made it possible for graduate students to gain first-hand knowledge of developments at the leading edge of their discipline, here in NZ.

3.4 Executive Administrator

Margaret Woolgrove has a background in research project management, both in New Zealand, where she worked for the Health Research Council from 1997 to 1999, and in the United States and Britain. She spent three years with the Michigan Public Health Institute in the USA, and has worked for both the University of Auckland and Massey University since she returned to New Zealand in 2002.

4. Chairman's Report

Sir Ian Axford reports:

It is wonderful to see New Zealand recognising and supporting centres of research excellence, especially in areas of fundamental importance to society and the economy, and we must all do what we can to make them succeed. The NZIMA has begun well, with appointment of an outstanding group of people to its International Scientific Advisory Board, beginning a suite of programmes in a variety of themes led by excellent people, and appointment of some very fine Maclaurin Fellows and postgraduate scholars.

The Governing Board is looking forward to playing a role in the ongoing development of the NZIMA, and shaping its strategy in the years ahead. In particular, there are some challenging issues to tackle with regard to building up the NZIMA's resource base, using its funding as leverage to obtain enhanced support for its activities and to further its mission, and creating its own identity.

I am delighted to offer these words on the first year of operation of the NZIMA, and to be involved as chair of its Governing Board. I congratulate all those involved in its establishment, and thank the Co-Directors and Executive for their efforts in making it a success.

5. Co-Directors' Report

Winning Centre of Research Excellence status and funding for the NZIMA last year gave a welcome and timely boost to the mathematical sciences in New Zealand, and we are pleased to be able to help take advantage of the opportunity this has presented.

During the first year of the NZIMA's existence we have selected four **thematic programmes** for special support over the period 2002 to early 2004, as follows:

- *Logic and Computation*, led by Professor Rob Goldblatt (Victoria University of Wellington)
- *Modelling Cellular Function*, led by Dr Nicolas Smith (University of Auckland).
- *Numerical Methods for Evolutionary Problems*, led by Professor John Butcher (University of Auckland)
- *Phylogenetic Genomics*, led by Professor Mike Steel (University of Canterbury).

These were chosen following consultation with our International Scientific Advisory Board and other members of the NZ mathematical sciences research community. The last two were partially funded, because of existing support from other sources.

Each programme is of approximately 6 months duration, and involves a concentrated period of activity centred around a meeting or workshop (held at an appropriate location in New Zealand), participation by visiting lead experts in the theme area, and the appointment of a postdoctoral fellow and a number of postgraduate research students.

Typically a programme is supported by a funding package that allows for a 3-month stipend for the Programme Director (plus overheads for his/her host institution), a 2-year Postdoctoral Fellowship (plus overheads for the host institution), scholarship support for two postgraduate research students (one at PhD level and one at Masters level), travel costs for invited experts from other countries to take part in the programme, and funding and administrative support through the NZMRI for costs and activities associated with the programme's key meeting/workshop (for accommodation, meals, facilities hire, other local expenses, for up to about 45 participants). Our Executive Administrator also helps with some of the arrangements.

We have also selected a number of people for the award of **Maclaurin Fellowships**, to enable them to spend a period of full-time research in New Zealand. These fellowships are of two types: one for researchers normally resident in New Zealand, tenable for one year, and the other for visiting researchers, tenable for one to three months. Each comes with a funding package that allows for a mix of stipend and travel expenses for the fellow, plus overheads for the host institution (in the case of the 1-year fellowships). Maclaurin Fellowships have been awarded to:

- Professor Rod Downey (Victoria University of Wellington), for all of 2003
- Professor Richard Laugesen (University of Illinois at Urbana-Champaign), visiting in 2003
- Dr Rod Gover (University of Auckland), for all of 2004
- Prof. Mike Steel (University of Canterbury), for all of 2004
- Prof. Hal Caswell (Woods Hole Oceanographic Institution), visiting in 2004.

We have decided to offer more visiting Maclaurin fellowships of shorter duration in future, to attract more high quality visitors and to optimise the research benefits of these.

At an early stage we allocated a small number of **scholarships in support of postgraduate research students** enrolled for PhD or Masters degrees in the mathematical sciences in New Zealand, on a merit basis (not necessarily tied to NZIMA thematic programmes). In addition, we decided to lend some support to a proposed programme in Industrial Mathematics by way of postgraduate scholarships for students engaged in research projects in industry. More details about these are given in the next Section.

In addition, we have allocated a small amount of our CoRE funding to the support of **local conferences** and **short visits to New Zealand by international figures** in a range of disciplines (as listed in the next Section), and a further sum to help with the costs of training and sending a team from New Zealand to take part in the International Mathematical Olympiad. We are amazed that the NZ government does not already provide regular support for the mathematical olympiad movement in this country, in contrast to most other countries that send teams.

The NZMRI's summer meeting (co-sponsored by the NZIMA) was an outstanding success, with ten invited speakers giving excellent courses of lectures on topics ranging from pure graph theory and enumeration through to the mechanics of DNA and RNA micro-array testing and the statistical analysis of its results, and over 40 mathematical scientists and 20 students taking part. Similarly, a whole issue of the journal *Electronic J. Combinatorics* was published to mark the conference on permutation patterns, and the support by the NZIMA was notably valuable (especially in terms of the benefit to younger researchers, who were able to use this as leverage with their host institutions to provide the remaining funding). We have also decided to support and promote the NZMRI's summer meeting to be held at Nelson in January 2004, and an international mathematics conference at Victoria University of Wellington in February 2004.

Similarly the NZIMA's sponsorship of a small number of international visitors has been highly successful. Relatively small amounts of money (spent mainly on travel costs) have led to new interactions and an increased level of excitement, especially among early and mid-career researchers. The pay off will be long-term and significant. We have also offered funding in support of forthcoming visits by two leading figures in mathematical economics, Professors Herve Moulin (Rice University, Texas) and Walter Bossert (Montreal, Canada).

We have set up offices for the NZIMA at the University of Auckland, on the Floor 3 of the same building in which the Departments of Mathematics and Statistics are housed (Building 303), on the corner of Princes and Wellesley Streets.

We would like to thank all those who have been involved positively in NZIMA's first year of operation, including (but not limited to) the following:

- Sir Ian Axford and other members of the Governing Board for their guidance and oversight
- Members of the Scientific Advisory Board for their advice and insight
- Members of the Executive Committee and others who have been involved in the selection of programmes and candidates for Maclaurin Fellowships, scholarships and other support
- Programme Directors and Maclaurin Fellows for their research and research leadership
- Margaret Woolgrove for her administrative support and perspicacity
- Professor Tom Barnes (DVC (Research)) and the Science Faculty Office at the University of Auckland for their help in establishing the NZIMA offices and accounts
- Sally Hallmark and Dr Don Smith of the Royal Society of NZ for their guidance in terms of reporting and CoRE monitoring

- Directors and managers of the other CoREs for sharing their experiences.

6. Research Highlights

6.1 Thematic programmes

➤ **Modelling cellular function** – Nicolas Smith et al (University of Auckland)

- This programme is concentrating on the development and use of analytic and computational models to characterise, simulate and elucidate the mechanisms of cell function
- Activities are well underway, with a conference taking place at Waiheke Island during the second week of July 2003, and an unexpectedly high level of interest from international participants (many of whom are contributing their own funds to cover costs of their involvement)
- A special issue of the journal *Progress in Biophysics and Molecular Biology* is being organised from the conference presentations, and this is likely to be published in March 2004 (with Nic Smith as guest editor)
- Two postdoctoral fellows (Drs Matt Halstead and Edmund Crampin) have been appointed, with funding from the NZIMA and the Wellcome Trust (UK)
- Several of the invited experts are staying on after the conference to work with locals involved in the programme — for example Dr Jose Puglisi (Chicago) is staying to work with Professor James Sneyd on calcium handling in myocytes, Dr Richard Clayton (Sheffield) to collaborate with Dr Nicolas Smith, and Dr Santiago Schnell (Oxford) to work with Dr Edmund Crampin
- Others are staying for longer periods — for example, Dr Satoshi Matsuoka and Professor Hidetoshi Kotera (Kyoto) are visiting for a 2-month period, to collaborate on the development of ventricular cell models
- Discussions are underway with Professor Jim Keener about the possibility of an exchange programme between Utah and Auckland for postgraduate students in bioengineering.

➤ **Logic and computation** – Rob Goldblatt et al (Victoria University of Wellington)

- The central focus of this programme involves research in the theories of computability and complexity, and the algorithmic study of randomness
- The programme has begun, but its most concentrated period of activity will be November 2003 through April 2004, with the programme's main workshop held in January 2004
- A postdoctoral fellow (Dr Yu Liang) has been appointed for a 2-year period
- Two postgraduate scholars have been appointed to the programme: David Friggens began in February 2003 and Ranald Clouston begins in July 2003.

➤ **Numerical methods for evolutionary problems** – John Butcher (University of Auckland)

- The principal aim of this programme is to develop numerical methods for the solution of ordinary differential equations, delay differential equations and differential-algebraic

equations, and special methods for problems that evolve on manifolds, within a geometric integration framework

- The programme is well underway, with a good number of international experts taking part, and a workshop held at the University of Auckland in mid-July 2003
- A postdoctoral fellow (Dr Helmut Podhaisky) has been appointed for a 1-year period
- Two PhD students have been appointed to the programme: Nicolette Moir and Shirley Huang, both of who are expected to complete their PhDs in the near future.

➤ **Phylogenetic genomics** – Mike Steel (University of Canterbury)

- This programme is concentrating on the development of combinatorial methods to use new types of genomic data to infer evolutionary information
- The main conference for this programme was held during the week 9–14 February 2003, in Kaikoura, with 55 people in attendance (including individuals from Sweden, France, Germany, Australia, Canada, USA, UK, and more than 20 from New Zealand)
- Several participants extended their visits to collaborate with researchers at the University of Canterbury — these included Dr Olivier Gascuel, who presented two seminars on gene duplication, and Tobias Dezulian (Tübingen) who began his PhD thesis on phylogenetic genomics
- An additional four-day workshop (organised jointly with the Allan Wilson Centre) for graduate students took place at Massey University from 14 to 17 April 2003, with a follow-up workshop from 1 to 4 July 2003 at the Max Planck Institute in Tübingen, Germany, and a further workshop is planned for February 2004 at Tongariro National Park
- Two postdoctoral fellowship candidates are being offered 6-month positions, beginning late 2003: Drs Stefan Grunewald and Magnus Bordewich
- Three Masters students are being engaged on the programme: Philip Daniel, Tobias Thierer, and one other (yet to be appointed).

6.2 Maclaurin Fellowships

- Professor Rod Downey (Victoria University of Wellington) is undertaking a year's concentrated research activity on algorithmic complexity, randomness and structure. He has used the valuable time created by his Maclaurin Fellowship to working on a research monograph "Algorithmic Randomness and Complexity" with Denis Hirschfeldt, and this is on course for a December completion. He has also been writing papers on "Calibrating Randomness" (invited for submission to the Bulletin of Symbolic Logic), "Complexity of the Random Reals" (jointly with Yu Liang and Ding Decheng), and "Kurtz Randomness" (jointly with Reid and Evan Griffiths).
- Professor Richard Laugesen (University of Illinois at Urbana-Champaign) is taking up a short-term visiting Maclaurin Fellowship at the Universities of Auckland and Canterbury in the second half of 2003.

- Professor Mike Steel (University of Canterbury), Dr Rod Gover (University of Auckland) and Professor Hal Caswell (Woods Hole Oceanographic Institute) will take up their fellowships in 2004.

6.3 Postgraduate Scholarships

- The following postgraduate research students are being supported by NZIMA scholarship funding awarded in open competition (on a merit basis):
 - Jean Zhaojing Gong, enrolled for a PhD in medical statistics at the University of Canterbury
 - Garry Nathan, completing a Masters degree in mathematics education at the University of Auckland
 - Tissa Senanayake, enrolled for a PhD in magnetohydrodynamics at the University of Waikato
 - Josef Silhan, enrolled for a PhD in differential geometry at the University of Auckland
 - Krasimira Tsaneva-Atanasova, enrolled for a PhD in cell modelling at the University of Auckland
- The NZIMA is lending support to research projects in Industrial Mathematics, with selection of students being arranged by Professor Robert McKibbin (Massey University at Albany). Just one student has been selected so far:
 - Asher Treby, undertaking an 18-month project in operations research for her degree in the Department of Engineering Science at the University of Auckland.

6.4 NZIMA-sponsored Conferences and Visitors

- The NZIMA used its CoRE funding and status to lend support to the following conferences held in New Zealand in 2002/03:
 - A workshop on Multilevel Statistical Modelling, held at Massey University in December 2002 (and organised by Associate Professor Stephen Haslett)
 - The NZMRI's summer meeting on "Combinatorics, with applications to combinatorial biology", held at New Plymouth the week 4-11 January 2003
 - A conference on Permutation Patterns, held at the University of Otago in February 2003 (and organised by Mike Atkinson).
- The NZIMA also sponsored the following visitors to New Zealand in 2002/03:
 - Dr John Chambers (Bell Laboratories), to work with Dr Ross Ihaka (University of Auckland) on statistical computing
 - Professor David Evans (Bristol), to work with Dr Mike Meylan (Massey University), Dr Colin Fox (University of Auckland) and Prof. Vernon Squire (University of Otago), on sea ice research
 - Professor Trevor Hastie (Stanford University), to work with Dr Thomas Yee (University of Auckland) on data mining and other questions in statistics

- Dr Kavita Ramanan (Lucent Technologies, Bell Labs), to work with Dr Ilze Ziedins (University of Auckland), on phase transitions in networks
- Dr Alastair Rucklidge (University of Leeds) to work with Dr Vivien Kirk (University of Auckland) on dynamical systems research.

6.6 Publications

The following is a selection of publications by researchers either supported or stimulated by (or otherwise involved with) the NZIMA's activities during 2002/03:

Albert, M.H.; Atkinson, M.D.: Sorting with a forklift. *Electronic J. Combinatorics* **9** (2003), R9 (23 pages).

Bona, M.: A Survey of Stack-Sorting Disciplines. *Electronic J. Combinatorics* **9** (2003), A1.

Bryant, D.; Huson, D.; Kloeppe, T.; Nieselt-Struwe, K.: Distance corrections on recombinant sequences, to appear in *Workshop on Algorithms in Bioinformatics 2003*.

Bryant, D.; Moulton, V.: NeighborNet: An agglomerative method for the construction of phylogenetic networks, accepted for *Molecular Biology and Evolution*.

Buist, M.L.; Sands, G.B.; Hunter, Peter J.; Pullan, Andrew J.: A deformable finite element derived difference method for cardiac activation problems. *Annals of Biomedical Engineering* **31** (2003), 577–588.

Bujalance, E.; Conder, M.D.E.; Cirre, J.: On extendability of group actions on compact Riemann surfaces, *Transactions of the American Mathematical Society* **355** (2003), 1537–1557.

Bujalance, E.; Conder, M.D.E.; Gamboa, J.M.; Gromadzki, G.; Izquierdo, M.: Double coverings of Klein surfaces by a given Riemann surface, *J. Pure & Applied Algebra* **169** (2002), 137–151.

Burstein, Alexander; Mansour, Toufik. Words restricted by patterns with at most 2 distinct letters. *Electronic J. Combinatorics* **9** (2003), R3.

Conder, M.D.E.: Hurwitz groups with given centre, *Bulletin of the London Mathematical Society* **34** (2002), 725–728.

Conder, M.D.E.; Bonnington, P.; McKenna, P.; Morton, M.J.: Embeddings of regular digraphs in orientable surfaces, *J. Combinatorial Theory, Series B* **85** (2002), 1–20.

Conder, M.D.E.; Dobcsányi, P.: Trivalent symmetric graphs on up to 768 vertices, *J. Combinatorial Mathematics & Combinatorial Computing* **40** (2002), 41–63.

Conder, M.D.E.; Maclachlan, C.; Martin, G.J.; O'Brien, E.A.: Two-generator arithmetic Kleinian groups III, *Math. Scandinavia* **90** (2002), 161–179.

Conder, M.D.E.; Maclachlan, C.; Todorovic Vasiljevic, S.; Wilson, S.E.: Bounds for the number of automorphisms of a compact non-orientable surface, *Journal of the London Mathematical Society* **68** (2003), 65–82.

Conder, M.D.E.; Marusic, D.: A tetravalent half-arc-transitive graph with nonabelian vertex stabilizer, *J. Combinatorial Theory Series B* **88** (2003), 67–76.

Conder, M.D.E.; Praeger, C.E.; Morton, M.J.: Two-arc closed subsets of graphs, *Journal of Graph Theory* **42** (2003), 350–364.

- Fernandez, J.W.; Mithraratne, P.; Tawhai, M.; Hunter, Peter J.: Geometric fitting and customization of anatomically based cubic Hermite finite element volume meshes. *Biomechanics and Modelling in Mechanobiology*, in press.
- Gardner, P.; Holland, B.; Moulton, V.; Hendy, M.; Penny, D.: Optimal alphabets for an RNA world, *The Royal Society Proceedings: Biological Sciences* **270** (2003), 1177–1182.
- Hästö, P.A.: The Packing Density of Other Layered Permutations. *Electronic J. Combinatorics* **9** (2003), R1.
- Holland, B.; Moulton, V.: Consensus networks: A method for visualising incompatibilities in collections of trees, to appear in *Workshop on Algorithms in Bioinformatics 2003*.
- Hooks, D.A.; Tomlinson, Karl A.; Marsden, S.G.; LeGrice, I.J.; Smaill, B.H.; Pullan, Andrew J.; Hunter, Peter J.: Cardiac microstructure: Implications for electrical propagation and defibrillation in the heart. *Circ.Res.* **9** (2002), 331–338.
- Hucka, M.; Bolouri, H.; Finney, A.; Sauro, H.M.; Doyle, J. C.; Kitano, H.; Arkin, A. P.; Bornstein, B. J.; Bray, D.; Cuellar, A.A.; Dronov, S.; Ginkel, M.; Gor, V.; Goryanin, I.I.; Hedley, W.J.; Hodgman, T.C.; Hunter, P.J.; Juty, N.S.; Kasberger, J.L.; Kremling, A.; Kummer, U.; Le Novère, N.; Loew, L.M.; Lucio, D.; Mendes, P.; Mjolsness, E.D.; Nakayama, Y.; Nelson, M.R.; Nielsen, P.F.; Sakurada, T.; Schaff, J.C.; Shapiro, B.E.; Shimizu, T.S.; Spence, H.D.; Stelling, J.; Takahashi, K.; Tomita, M.; Wagner, J.; Wang, J.: The Systems Biology Markup Language (SBML): A medium for representation and exchange of biochemical network models. *Bioinformatics* **19** (2003), 524–531.
- Hunter, Peter J.; Robbins, P.; Noble, D.: The IUPS Human Physiome Project. *European Journal of Physiology* **445** (2002), no. 1, 1–9.
- Hunter, Peter J.; Borg, T.K.: Integration from proteins to organs: The Physiome Project. *Nature Reviews Molecular and Cell Biology* **4** (2003), 237–243.
- Hunter, Peter J.; Pullan, Andrew J.; Smaill, Bruce H.: Modelling total heart function. *Ann. Review of Biomedical Engineering*, in press.
- Iwaniec, T.; Koskela, P.; Martin, G.J.: Mappings of BMO-distortion and Beltrami-type operators. Dedicated to the memory of Tom Wolff. *J. Anal. Math.* **88** (2002), 337–381.
- Iwaniec, T.; Koskela, P.; Martin, G.J.; Sbordone, C.: Mappings of finite distortion: $\log \chi$ -integrability. *J. London Math. Soc. (2)* **67** (2003), no. 1, 123–136.
- Iwaniec, T.; Martin, G.J.: Squeezing the Sierpinski sponge. *Studia Math.* **149** (2002), no. 2, 133–145.
- Malcolm, D.T.K.; Nielsen, M.F.; Hunter, Peter J.; Charette, G.: Strain measurement in biaxially tested elastic membranes. *Biomechanics and Modelling in Mechanobiology* **1** (2002), 211–218.
- Marshall, T.H.; Martin, G.J.: Packing strips in the hyperbolic plane. *Proc. Edinb. Math. Soc. (2)* **46** (2003), no. 1, 67–73.
- Martin, G.J.: Analytic continuation for Beltrami systems, Siegel's theorem for UQR maps, and the Hilbert-Smith conjecture. *Math. Ann.* **324** (2002), 329–340.
- Nash, M.P.; Nickerson, D.P.; Smith, Nicolas P.; Hunter, Peter J.: Computational Electromechanics of the Heart, Mathematical and Computational Modeling of Biological Systems 19, *Centro Internacional de Matematica*, Chapter 2, 39–85.

Nielsen, M.F.; Malcolm, D.T.K.; Hunter, Peter J.; Charette, G.: Instrumentation and procedures for estimating the constitutive parameters of inhomogeneous elastic membranes. *Biomechanics and Modelling in Mechanobiology* **1** (2002), 197–210.

Silhan, Josef. A real analog of Kostant's version of the Bott-Borel-Weil theorem. *Journal of Lie Theory*, accepted, to appear.

Smith, Nicolas P.; Pullan, Andrew J.; Hunter, Peter J.: An anatomically based model of coronary blood flow and myocardial mechanics. *SIAM J. Applied Mathematics* **62** (2002), 990–1018.

Sneyd, J.; Tsaneva-Atanasova, K.; Straub, S.; Yule, D.: A model of calcium waves in pancreatic and parotid cells. *Biophysical J.*, in press.

Sneyd, J.; Tsaneva-Atanasova, K.: Modeling calcium waves. *Lecture notes in Physics*, in press.

Stevens, C.; Hunter, Peter J.: Sarcomere length changes in a model of the pig heart. *Prog. Biophys. Molec. Biol.* **82** (2003), 229–241.

Stevens, C.; Remme, E.W.; LeGrice, I.J.; Hunter, Peter J.: Ventricular mechanics in diastole: material parameter sensitivity. *Journal of Biomechanics* **36** (2003), 737–748.

Tomlinson, Karl A.; Hunter, Peter J.; Pullan, Andrew J.: A finite element method for an eikonal equation model of myocardial excitation wavefront propagation. *SIAM J. Appl. Math.* **63** (2002), no. 1, 324–350.

Vatter, V.R.: Permutations avoiding two patterns of length three. *Electronic J. Combinatorics* **9** (2003), R6.

6.7 Conference and other presentations

Marston Conder gave an invited plenary lecture on "Symmetric and semisymmetric cubic graphs" at the 2nd Conference on Symmetries of Graphs, Maps and Complexes (SIGMAC'02) held at Aveiro (Portugal) in July 2002, a short address at the Memorial Service for Professor Bernhard Neumann held at the ANU in Canberra in December 2002, an invited lecture on "Some unexpected theoretical consequences of computations with groups" at a conference on Groups and Computation at Ohio State University in March 2003, a lecture on "Regular Cayley maps for finite groups" at the PIMS-sponsored conference on the Graph Theory of Brian Alspach at Simon Fraser University, BC (Canada) in May 2003, the opening lecture "Questions arising from group actions on the cubic tree" at a conference on Algebraic Combinatorics, at Koper (on the Adriatic Coast of Slovenia), and a lecture on "Regular Cayley maps for finite abelian groups" at the 5th Slovenian Conference on Graph Theory, at Lake Bled (Slovenia), in June 2003.

Professor Rod Downey (Maclaurin Fellow) gave a series of six lectures on "Algorithmic Randomness and Complexity" at the Universities of Chicago, Illinois at Urbana-Champaign, and Notre Dame. He also delivered a plenary lecture at a meeting on Kolomogorov Complexity in Heidelberg (Germany).

Krasimira Tsaneva-Atanasova (NZIMA scholar) delivered a paper "Mathematical study of cytosolic calcium oscillations" at the New Zealand Mathematical Colloquium in Auckland in December 2002.

Professor Trevor Hastie (an NZIMA-sponsored visitor) gave a lecture on "Support Vector Machines, Kernel Logistic Regression and Boosting" and his host Dr Thomas Yee gave a lecture "An Introduction to Data Mining" at a Data mining workshop held at Ruakura in April 2003.

7. International Linkages

The NZIMA has become a member of the International Mathematical Sciences Institutes (IMSI), an international consortium of research institutes in the mathematical sciences that run thematic programmes and have large visitor programmes, and is listed on the IMSI website.

Communication linkages with such institutes were set up through visits by the two Co-Directors to overseas institutes (often while attending other conferences) during the year. Marston Conder and Vaughan Jones visited the Mathematical Sciences Research Institute (MSRI) in California and the Fields Institute in Ontario mid-2002, and met with the directors of both. Marston Conder visited the Centre for Mathematics and its Applications in Canberra briefly in December 2002, coincidentally on the day of the announcement of Centres of Research Excellence funding the Australian Mathematical Sciences Institute (AMSI), which is a 3-way initiative between the Universities of Melbourne and New South Wales and the ANU, and discussed possibilities for trans-Tasman inter-institute cooperation. He also visited the Molecular Biosciences Institute (MBI) at Ohio State University in March 2003 and met with the MBI's Director, Prof. Avner Friedman, who is former director of the Institute of Mathematics & its Applications at Minnesota, and visited a site office of the Pacific Institute for the Mathematical Sciences (PIMS) in British Columbia, in May 2003.

In each case it was helpful to discuss the challenges and opportunities in building up centres like these, and to gain insights into the selection and funding of programmes and other activities. Also Margaret Woolgrove (the NZIMA's Executive Administrator) visited the Isaac Newton Institute in Cambridge (England) and the International Centre for Mathematical Sciences in Edinburgh (Scotland) to learn more about their administrative processes, while on annual leave in early 2003. Professor David Evans (from the University of Wales at Cardiff) visited briefly in January 2003, after taking part in the NZMRI's summer meeting, and discussed recent initiatives to establish a mathematical research institute in Wales (along similar lines to the NZIMA).

Very strong international linkages have been developed by the NZMRI through its earlier programme of annual summer workshops, and these will be taken further by NZIMA programmes through the involvement of invited overseas experts. The NZIMA's website is another useful vehicle for maintaining and enhancing international contacts.

These linkages are also being maintained through the NZIMA's International Scientific Advisory Board (Section 2.2), which includes a number of prominent New Zealand-born mathematical scientists resident overseas and representatives from other members of the IMSI (such as the CMA, MSRI and PIMS). Members of this advisory board are invited to participate in the NZIMA's activities, and two of them (Professors Andreas Dress (Bielefeld) and Keith Worsley (Montreal) took up this opportunity in the early part of 2003.

In addition, Marston Conder met with Dr Rita Colwell, Director of the US National Science Foundation (NSF), while she was in Auckland for the second Knowledge Wave Conference. Dr Colwell advised that *the mathematical sciences form one of the NSF's five top priority areas*, and offered some very useful advice about opportunities to pursue, and also warned about the increasing demand worldwide for well-qualified graduate students.

8. Staff Awards

NZIMA Co-Director Vaughan Jones was made a Distinguished Companion of the New Zealand Order of Merit (DCNZM) at a ceremony at Government House in Wellington in August 2002. This award recognises the outstanding scientific achievements of Vaughan Jones and the many contributions he has made to stimulate high quality research and the encouragement of graduate students in New Zealand.

Professor Peter Hunter (member of the NZIMA Governing Board and also a member of the committee for the NZIMA programme in Modelling Cellular Function) was elected in 2002 to the World Council of Biomechanics and also to the Council of the IEEE Engineering in Medicine and Biology Society (EMBS), and in 2003 was appointed to a 5-year Visiting Professorship in Computational Physiology at the University of Oxford, and to a Consultant Editorship of the Journal of Experimental Physiology, and elected a Fellow of the International Academy of Medical & Biological Engineering (IAMBE).

Professor Gaven Martin (member of the NZIMA Governing Board and a Co-Director of the NZMRI) continued his tenure of a James Cook Research Fellowship in 2002/03, and was granted an extension of this fellowship for a third year. Also during 2002/03 he held visiting positions at Wesleyan University, Connecticut (as Van Vleck Professor), Université de Lille, France (as CNRS visiting Professor), University of California at Berkeley (as Miller Professor), and the Institute for Advanced Study, Princeton.

9. Financial Reports

This is a limited report on the financial performance and financial position of the NZIMA at the end of its first year of operation. It covers only the activity supported by the award to it from the NZ government's Centres of Research Excellence (CoRE) Fund. It is expected that in future years the NZIMA's financial reports will cover a wider range of activity.

9.1 Statement of Financial Performance for 2002/03

Income	Actual	Budget	Variance
CoRE Funding	\$ 1,324,444	\$ 1,324,444	\$ 0
Host/ Partner Support	7,066	37,990	(30,924)
Total Income	\$ 1,331,510	\$ 1,362,434	\$ (30,924)
 Expenditure	 Actual	 Budget	 Variance
<i>Salaries</i>			
Director & Principal Investigators	\$ 62,102	\$ 75,000	\$ (12,898)
Associate Investigators	30,000	145,000	(115,000)
Postdoctoral Fellows	12,368	110,000	(97,632)
Research/ Technical Assistants			
Others	30,930	40,000	(9,070)
<i>Total Salaries (a)</i>	<i>\$ 135,400</i>	<i>\$ 370,000</i>	<i>\$ (234,600)</i>
<i>Other Costs</i>			
Indirect Costs: Overheads	\$ 87,521	\$ 370,000	\$ (282,479)
Direct Costs: Project Costs	36,500	180,000	(143,500)
Travel	40,216	120,000	(79,784)
Postgrad Student Stipends	88,710	199,444	(110,734)
Equipment depreciation	14,619	37,990	(23,372)
Rental - equipment	60,534	65,000	(4,466)
Subcontractors	0	0	0
Extraordinary expenditure	0	20,000	(20,000)
<i>Total Other Costs (b)</i>	<i>\$ 328,100</i>	<i>\$ 992,434</i>	<i>\$ (664,334)</i>
Total Expenditure	\$ 463,500	\$ 1,362,434	\$ (898,934)
 Operating Surplus	 \$ 868,010	 \$ 0	 \$ 868,010

Notes:

- Expenditure during 2002/03 has been relatively light, but will step up in the 2003/04 financial year as further programmes get underway. The amount shown as "operating surplus" here is committed and will be carried forward for expenditure in 2003/04.
- The Budget figures for some expenditure items will need to be adjusted for future years.

9.2 Statement of Financial Position as at 30 June 2003

The assets of the NZIMA are property of the University of Auckland and are treated as part of the University of Auckland's accounts.

These assets are limited in tangible value. In March 2003 the NZIMA used the sum of \$113,790 it acquired from the CoRE capital fund to purchase a Dell rack-mounted "Mosix" computer cluster, consisting of 7 dual-processors and 3 single processors (with a CPU of 2.8GHz each, and total memory of 2.8Gb), plus network accessories. This computer cluster is being trialled by the Co-Directors and some students and colleagues in the Mathematics Department of the University of Auckland (which is contributing the cost of depreciation over three years). It will also be made available to others involved in NZIMA programmes in the near future. There are no outstanding capital items to be purchased out of the CoRE capital funding.

10. Directory of key contacts

10.1 Chair of the NZIMA Governing Board

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10.2 Co-Directors

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10.3 Executive Committee Members

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Professor David Ryan *MSc (Otago) PhD (ANU) CMath FIMA FIPENZ*
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Dr Graham Weir *MSc PhD DSc (Canterbury) FRSNZ*
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10.4 Executive Administrator

Margaret Woolgrove *MA (Hons) (St Andrews)*
 New Zealand Institute of Mathematics and its Applications, University of Auckland
 Private Bag 92019, Auckland, New Zealand

10.5 NZIMA Website

URL: <http://www.nzima.auckland.ac.nz>