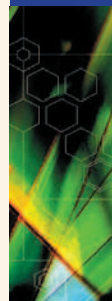
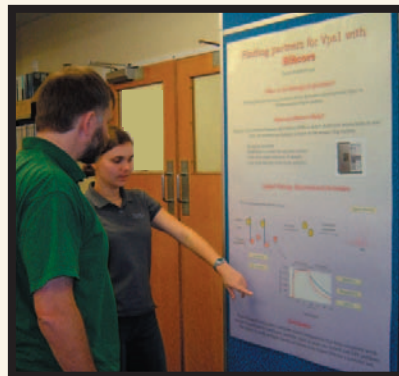
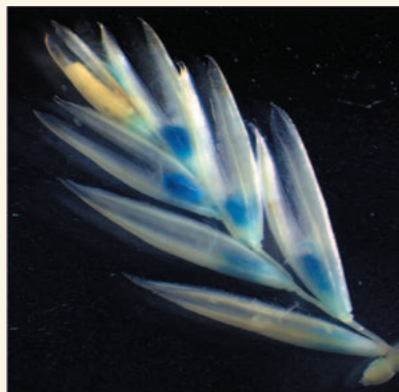
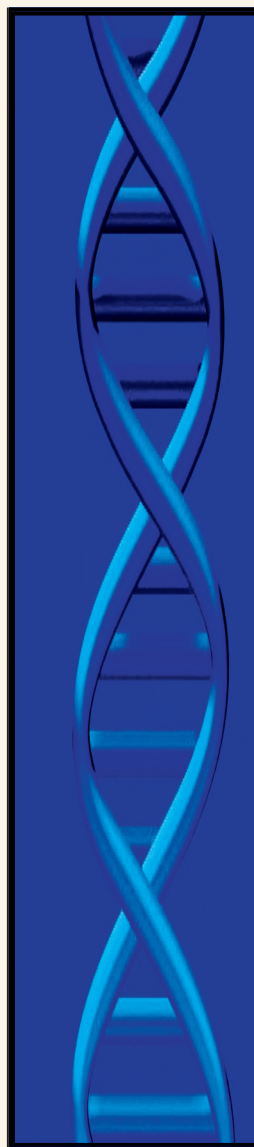


INSTITUTE OF MOLECULAR BIOSCIENCES

ANNUAL REPORT



Our Mission Statement

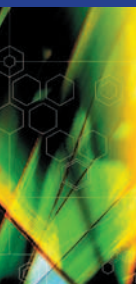
**Excellence in research
and research-based teaching**

Front cover (from top)

Hayley Lawrence and Damien Fleetwood receive their MacDiarmid award

Perennial ryegrass spikelets colonised by *Epichloë festucae* hyphae. Photo courtesy of Dr Kimberley May

Dr Mark Patchett and Sarah Röthlisberger at the Research Methods Technology poster evening

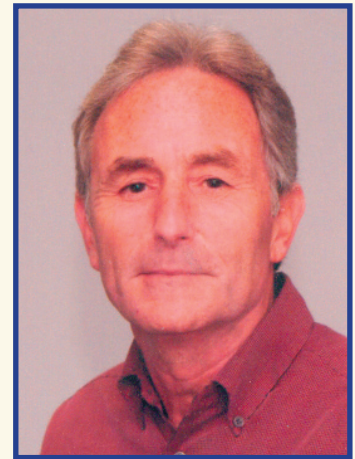


Contents

Head of Institute's Message	4
Academic Staff Arrivals and Departures	5
Awards and Promotions	6
Publications	7
Journal Covers	10
Research Highlights	11
Batt Lecture	13
Distinguished Seminars in Cancer Biology	13
Seminars	14
Molecular Systematics at the University of the South Pacific	16
Conferences	17
Manawatu Science and Technology Fair	18
Postgraduates	19
Postgrad Programme at Albany	22
MacDiarmid Awards	23
Grants and Awards	24
IMBS Awards	27
MMIC	28
Research Income	29
Additions	31
2007	32

Head of Institute's Message

2006 marked the end of the age of innocence for the New Zealand university system. It might just have been possible to ignore the 2003 PBRF but not taking the 2006 exercise seriously was tantamount to academic suicide. As I write this the full implications of the latest review of university research excellence have still to be fully digested but the early indications are that, by 2008, when the fruits of 2006 will start to fall from the vine, something like half of the IMBS' EFTs-related income will come through PBRF. For an institution that is also dedicated to high quality teaching, such riches bring their own problems. In particular, how do we continue to deliver outstanding undergraduate and postgraduate teaching whilst at the same time allowing staff sufficient research time to ensure that we do even better in the next PBRF in 2012?



One of the endearing eccentricities of the academic community is that while we effortlessly embrace new concepts and techniques in our research, we firmly resist radical changes to the way we teach. Our approach to teaching in 2006 was much the same as it was in 1996 and even 1986. Yet the ease of access to information and the means of communicating this to our students have changed out of all recognition. I am not suggesting that we replace all lectures with podcasts but we do need to radically rethink how and what we deliver to a student community that I suspect is far more comfortable with the new reality than we are. To do better in 2012 we do not have to work harder but we do have to work smarter. We also have to hope that the Massey University administration will be more proactive and professional in its support for research. As I have said many times in the past, if you get the research right excellent teaching will follow. It does not work the other way round.

I am extremely proud of the achievements of the IMBS in 2006, only some of which are highlighted in the following pages. IMBS staff have published in the world's leading journals and have contributed to meetings and conferences far and wide. We continue to attract outstanding postgrads and postdocs, all of which has contributed to an exciting research environment that has helped us attract exceptional young faculty. We continue to invest in new research facilities, the most notable being a new state of the art microscopy centre, the Manawatu Microscopy and Imaging Centre, which will open in 2007. Massey University has demonstrated its confidence in the IMBS by approving a number of new faculty positions which will both build on existing strengths and allow us to explore new avenues of research. For the IMBS, as with all similar organisations throughout New Zealand, the future holds many, many challenges. However, with the support of an outstanding community of academic, technical and general staff and a talented and enthusiastic cohort of postgrads and postdocs we are in great shape to head towards 2012 with confidence and enthusiasm.

Jerry Hyams

Academic Staff

Arrivals

Vaughan Symonds

Vaughan joined the Turitea branch of IMBS in 2006. He graduated from the University of Texas-Austin before working as a postdoc at the University of Florida. His area of interest is understanding the genetic and molecular bases of morphological variation within and among populations and closely related species. He is also involved with the genetic structuring of populations and the mechanisms that generate, maintain, and reduce such structures.



Jennifer Tate

Jennifer graduated from the University of Texas-Austin before moving on to the University of Florida to work as a postdoctoral research associate. Her research interest is the evolution of plant polyploids, in particular to identify progenitor species of natural polyploids, so that the genetic, genomic, and phenotypic consequences of polyploidy in natural systems can be understood.



Departures

Armaz Aschrafi

Armaz has moved to a position at the National Institute of Mental Health. NIMH is one of 27 components of the United States National Institutes of Health (NIH), the Federal government's principal biomedical and behavioural research agency.



George Ionas

After completing his PhD at Massey in 1989, George joined IMBS as a UGC Postdoctoral Fellow. He became Director of MicroAquaTech in 2002. George has recently joined his family's business.



John Tweedie

After 45 years as an undergraduate, postgraduate student and faculty member at Massey, John retired at the end of the year. He is not lost to Massey completely, and will be around until the end of June 2008, teaching on a part-time contract.



David Penny - New Years Honours Award

In the New Years Honours Awards for 2006 Distinguished Professor David Penny was made a Companion of The New Zealand Order of Merit (C.N.Z.M.) for services to Science.

The Order recognises "those persons who in any field of endeavour, have rendered meritorious service to the Crown and nation or who have become distinguished by their eminence, talents, contributions or other merits."



David was accompanied by his family at the award ceremony.
(Left to Right) Marian Pybus, Kim Penny, David Penny, Pauline Penny, John Penny

Academic Promotions



Associate Professor Peter Lockhart was promoted to Professor of Molecular Evolution



Associate Professor Michael McManus was promoted to Professor of Plant Physiology



Dr Peter Farley was promoted to Senior Lecturer



Dr Max Scott was promoted to Associate Professor

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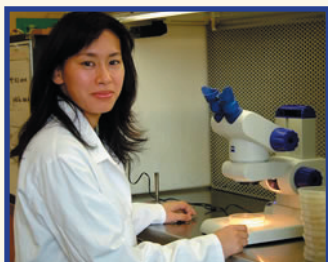
Journal Covers



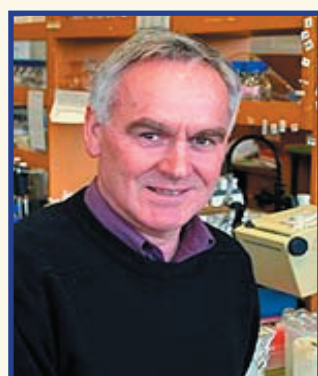
Barbara Ambrose's scanning electron micrograph of a nearly mature flower of *Lacandonia schismatica* was on the cover of the *American Journal of Botany*. It was coloured to highlight the three central stamens (aqua), the surrounding carpels (steel blue), and styles (yellow). The six surrounding tepals are not shown. This paper is part of a larger project that, in collaboration with local indigenous communities, is aimed at collectively developing local capacity for documenting local flora and fauna and conservation of the Lacandon Rain Forest. Credits: Photograph by B. A. Ambrose, coloured by Fernando Mercedes. The cover was dedicated to Don Gabriel Aguilar, a scholar of Mesoamerican tropical flora, who collected thousands of plant samples for many important flora projects including *Flora Mesoamericana* and was instrumental in the discovery by Esteban Martinez and Clara Ramos of *Lacandonia schismatica*.

Research Highlights

A new biological role for reactive oxygen species (ROS)



Dr Aiko Tanaka



Professor Barry Scott



Dr Daigo Takemoto

In two high profile publications in *Plant Cell*, Aiko Tanaka, Barry Scott and Daigo Takemoto have identified a new biological role for reactive oxygen species. In the first publication they showed that disruption of a gene (*noxA*) encoding a specific NADPH oxidase isoform in *Epichloë festucae*, a mutualistic symbiont of perennial ryegrass, converts this fungal endophyte from a mutualist to a pathogen (Tanaka et al. 2006). In wild-type associations, fungal hyphal growth is synchronized with that of the host throughout the life cycle of the grass. Disruption of *noxA* results in an increase in hyphal branching and a dramatic increase in fungal biomass in all tissues. As a consequence plants become severely stunted and show precocious senescence.

Protein sequence analysis predicts that NoxA is very similar in structure and function to the mammalian gp91phox, the catalytic component of a multi-enzyme oxidase responsible for the phagocytic oxidative burst that occurs when neutrophils are activated by microbial or inflammation signals. Activation of gp91phox involves relocation of several regulatory subunits, including p67phox and the small GTPase RAC, from the cytosol to the cell membrane. In their second publication they identified homologues of p67phox and RAC in fungal genomes, designated *noxR* and *racA*, and showed by deletion analysis in *E. festucae* that both are required to maintain a mutualistic symbiotic interaction (Takemoto et al. 2006).

Their working model proposes that hyphal tip growth and branching *in planta* is controlled by localized bursts of ROS catalysed by NoxA, following recruitment of RacA and NoxR from the cytosol to the cell membrane in response to signalling from the grass host.

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Tanaka A, Christensen MJ, Takemoto D, Park P & Scott B (2006). Reactive oxygen species play a role in regulating a fungus-perennial ryegrass mutualistic interaction. *Plant Cell* 18: 1052-1066.

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Continued overleaf...

Versatile protein gets a virus in and out of bacterial membranes



Dr Jasna Rakonjac

In an article published by the prestigious *Journal of Molecular Biology*, Nicholas Bennett and Jasna Rakonjac present evidence that bacterial virus or bacteriophage f1/M13 makes very economical use of its resources. F1/M13 is unique among viruses in that it employs the same domain of the same protein, C-domain of pIII, for two processes: entering the host cell in the beginning of infection, and leaving the cell at the end of the life cycle. Phage assembly occurs at the cellular membrane and the C-domain of pIII, itself a membrane protein, mediates release of the virion. Now Bennett & Rakonjac show that for infection a functional C domain of pIII covalently attached to the receptor-binding domains N1 and N2 is required. This finding led to a new model of phage infection: the C-domain of pIII undergoes conformational change triggered by binding of the N1/N2 domains to the host cell receptors, which in turn exposes the “membrane anchor” of pIII and insertion of the pIII and other virus proteins into the membrane.



Nicholas Bennett

f1/M13 is the workhorse of phage display technology, used to create human therapeutic antibodies. In contrast, filamentous phages of *Neisseria meningitidis*, *Yersinia pestis* and *Vibrio cholerae* have a more sinister role – to spread toxin genes to non-pathogenic strains. Deciphering the mechanism of f1/M13 infection will help improve phage display technology and understand the spread of toxin-encoding filamentous phages among the enteric bacteria.

Reference: Bennett, N.J. and Rakonjac, J. (2006). Unlocking of the filamentous bacteriophage virion during infection is mediated by the C domain of pIII. *Journal of Molecular Biology* 356: 266–273. (Based on the Masters Thesis of Nicholas Bennett).

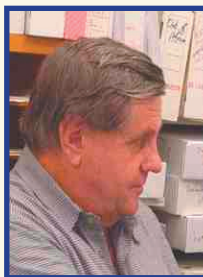
Science article challenges evolutionary thinking



Dr Lesley Collins

Based on the analysis of data from many sources, this feature in *Science* finds no direct evidence that eukaryotes evolved by genome fusion between archaea and bacteria as many scientists believe. Bacterial ancestors may have been forced into simpler lives by the appearance of the first cell to feed on other cells, an ancestral predatory eukaryote dubbed “Fred the Raptor.” Fred’s debut would have had a major ecological impact on the evolution of gentler descendants of the Common Ancestor.

Another phenomenon called “molecular crowding” could also explain the unique architecture of eukaryotes. When cells become crammed with proteins in a concentration so thick it’s almost like jelly, it becomes hard for the proteins to move and work together. To avoid this problem, “working groups” of proteins sort themselves into separate compartments. Because protein diffusion is so restricted under such high concentrations, it is really essential, especially in large cells, to have proteins together that function together.



Prof David Penny

Comparative genomics shows us that, under certain ecological settings, sequence loss and cellular simplification are common modes of evolution. Well-known examples of genome reduction in nature include fungi (such as baker’s yeast) and parasites that have much smaller genome sizes than their free living relatives. Once we understand more about ‘Fred’, our ancestral eukaryote, we can then begin to seriously test the numerous models surrounding his origins.

Reference: Kurland, C.G., Collins, L.J. & Penny, D. (2006). Genomics and the Irreducible Nature of Eukaryotic Cells. *Science* 312: 1011-1014.

Batt Lecture

The Richard Dean Batt Memorial Lecture series was inaugurated in 1994 to honour Dick Batt, a leader in science at Massey University, as Head of Department and Dean of Science, over many years.

The lecture series is held every other year. A distinguished scientist delivers a lecture of a general nature to the public in memory of Richard Batt.

In 2006 we were fortunate to have Dr Ian Gibson, MP, present a lecture entitled "Science and Politics: Two Cultures?"



Dr Ian Gibson

Ian was a distinguished molecular biologist and cancer researcher at the University of East Anglia, UK, where he also served as Dean of the School of Biological Sciences, before becoming Member of Parliament for Norwich North in 1997. He has been a powerful voice in the House of Commons, speaking out for both the universities and for research. He served for nine years on the Parliamentary Science and Technology Select Committee, the last 5 years as Chairman.

Distinguished Seminars in Cancer Biology

Two distinguished cancer researchers presented their work to the IMBS in a seminar series co-sponsored by the Palmerston North Medical Research Foundation. Professor Anthony Reeve from the University of Otago presented a seminar entitled "Cancer behaviour and genetic chaos" and Professor Bernard Ducommun from the Université Paul Sabatier, Toulouse, France, discussed his work in a seminar entitled "CDC25 protein phosphatases, the cell cycle and cancer".



Professor Bernard Ducommun



Professor Anthony Reeve

Seminars

Professor Charles Kurland Uppsala University, Sweden
Searching cellular protein space for the origins of eukaryotes

Michelle Bryant IMBS
Functional analysis of genes for hydrolytic enzymes in the *E. festucae*-perennial ryegrass symbiosis

Professor Jim Whitfield University of Illinois at Urbana-Champaign, USA
Parasitoids, polydnaviruses and phylogenetics: A mixed-up tale

Distinguished Seminars in Cancer Biology

Professor Anthony Reeve University of Otago
Cancer behaviour and genetic chaos

Dr Pierdomenico Bellini IMBS
A biochemical basis for the regulatory flexibility of a Fur superfamily protein in different bacterial backgrounds

Dr Scott Roy Allan Wilson Centre
Gene structures through eukaryotic history: solved and remaining mysteries

Dr Katrin Grage IMBS
Heme biosynthesis in bacteria: Investigation of the oxygen-independent coproporphyrinogen III oxidase

Dr Christina Moon AgResearch-Grasslands
Analyses of plant-induced genes in the plant-associated bacterium, *Pseudomonas fluorescens*

Dr Debbie Young University of Auckland
Viral vectors: tools for neurological disease modelling

Dr Julie Dalziel AgResearch Grasslands
Fungal toxins and human ion channels: insights into ryegrass staggers syndrome

Dr Daigo Takemoto IMBS
Recruitment of a fungal NADPH oxidase regulator, NoxR, to control hyphal branching in a fungal plant symbiosis

Dr Emily Parker Institute of Fundamental Sciences, Massey University
Evolving enzymes: Exploring the interplay of sequence, structure and reaction chemistry in a family of crucial biosynthetic enzymes

Dr Catherine Day Otago University
Bcl-2 proteins and apoptosis: A structural perspective

Dr Michael Lane IMBS & University of Saskatchewan, Canada
Biochemical and molecular characterisation of FliI and FliH from *Helicobacter pylori*

Distinguished Seminars in Cancer Biology

Professor Bernard Ducommun Université Paul Sabatier, Toulouse, France
CDC25 protein phosphatases, the cell cycle and cancer

The 7th R.D. Batt Memorial Lecture

- Dr Ian Gibson Member of Parliament for Norwich North, UK
Science and politics: Two cultures?
- Dr Louis Irving Institute of Natural Resources, Massey University
Protein turnover and its regulation in grasses; implications for development and yield
- Research Assoc Prof Petr Pancoska Department of Pathology, Stony Brook University USA
Global non-neutral evolution is pervasive in the genomes of higher vertebrates
- Dr Julia Horsfield University of Auckland
Developmental roles for cohesion: a novel use for glue
- Assoc Prof Jesús Aguirre Instituto de Fisiología Celular, National Autonomous University of Mexico
NADPH oxidases in fungal growth and development
- Dr Zac Cande Department of Molecular and Cell Biology University of California, USA
A tale of two nuclei: Mitosis and cytoskeletal function in the basal eukaryote *Giardia intestinalis*
- Dr Richard Kingston School of Biological Sciences, University of Auckland
Structural studies on the replication machinery of measles virus
- Distinguished Professor David Parry Institute of Fundamental Sciences, Massey University
“Hair today – gone tomorrow” - Lateral and axial structure of keratin intermediate filaments
- Professor Chris Danpure Department of Biology University College London
Diet and the evolution of enzyme targeting
- Sanjay Saikia IMBS
Functional analysis of *Penicillium paxilli* genes required for biosynthesis of paxilline
- Dr Matthew Nicholson IMBS
Anaerobic fungi: molecular biology and life in the rumen
- Laureate Professor Peter Doherty Department of Immunology St Jude Children’s Research Hospital, Memphis Tennessee USA
Adventures with killers
- Dr Joel Tyndall National School of Pharmacy University of Otago
Structure motif recognition in drug design
- Dr Johanna Montgomery Faculty of Medical of Health Sciences, University of Auckland
Controlling plasticity of neuronal circuitry in the brain
- Dr David Palmer Agriculture and Life Sciences Division, Lincoln University
Progress on ovine Batten disease studies towards *in vivo* stem cell correction gene therapy
- Professor Jim Murray Institute of Biotechnology, University of Cambridge, UK
The plant cell cycle: Regulation of division and its integration with development

Developing Molecular Systematics at the University of the South Pacific

In 2002 a MoU was signed between the Allan Wilson Centre (AWC) and the University of the South Pacific to develop collaborative research and education initiatives in the South Pacific, a hot spot for biodiversity and biosecurity in the Pacific/Australasian region. Following this, the AWC and Massey University funded two workshops in molecular biology/molecular systematics at USP (2002, 2003), provided summer scholarships for USP staff and students at Massey University (2004, 2005, 2006) and supported research visits at USP for AWC staff (2004).

In 2006 a proposal by Massey University, through the AWC, to establish a centre for molecular systematics at USP was funded by NZAid. USP is the major Tertiary Education provider in the South Pacific Region, covering the Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. A programme of postgraduate study in molecular systematics was initiated and steps taken to develop the necessary technical skills (DNA extraction, PCR, sequencing, electrophoretic profiles-fingerprint patterns). This programme is fronted by Peter Lockhart, Professor of Molecular Evolution in the IMBS and Principal Investigator in the AWC. In parallel, Landcare Research has also been funded by NZAid to develop herbarium resources at USP.

The new laboratory was opened in May 2007 by the New Zealand High Commissioner Mr Michael Green. Peter Lockhart was a guest at the opening and in attendance were many senior USP staff, including Prof. Linton Winder, Prof. Bill Aalbersberg and postgraduate students selected for study in the postgraduate molecular systematics programme at USP.

Amongst other projects, the new lab will focus on the conservation biology of Fiji's native flower, *Tagimaucia* and its ground frogs, the phylogeography of swallowtail butterflies and the systematics of marine sponges. A Fijian researcher is associated with each project. Two of these, Arti (research technician) and Tamara (PhD candidate), had 3 month research stays at Massey University, during which time they obtained sequence data, undertook training in sequence analysis and identified microsatellite markers for their respective projects. Arti also produced scanning electron micrographs for *Tagimaucia*.

Pete Lockhart's view is that there is considerable potential for molecular systematic studies at the University of the South Pacific. A key to the success of individual projects and value of embedding molecular systematics expertise in the South Pacific region to Environmental/Conservation/Agricultural and Fishery managers will be the close integration of genetic data with biological collections and environmental spatial data.



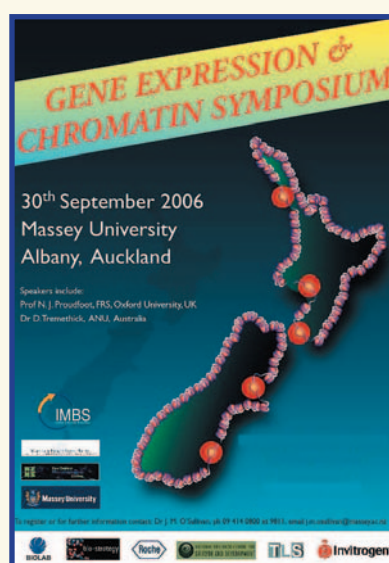
(left to right) Mere Yabaki-Goundar, Tamara Osborne, Hilde Waqa, Sunil Sing, Professor Peter Lockhart, Mereoni Degei Gonelevu and Professor Linton Winder (Associate Dean, Research & Consultancy at USP). Absent: Arti Reddy

Conferences

Staff from IMBS played major roles in organising two conferences in 2006.

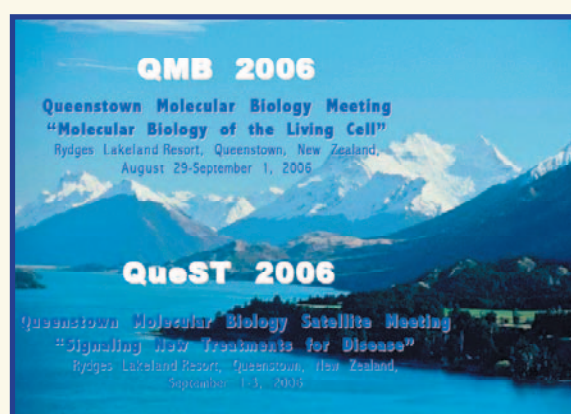
New Zealand Gene Expression Conference

Dr Justin O'Sullivan organised the New Zealand Gene Expression Conference. Over 60 scientists from New Zealand, Australia, and U.K. gathered at the Massey University campus in Albany for the one day symposium. This was the first symposium organised under the auspices of the Eukaryotic Microbiology Special Interest Group (SIG) and it focused on Gene Expression in Eukaryotes. Attendance at the symposium was free and fifteen high quality talks, covering different aspects of gene expression and chromatin, in a wide variety of eukaryotic organisms, were presented throughout the day. As such, it was an opportunity for different academic and industrial research groups to meet, share information and ideas within an area which is of central importance to our health, biotechnological and agricultural industries. In addition to the talks there were excellent trade displays. These all contributed to what can only be described as a successful day which concluded with conversations over drinks and a meal at a local restaurant.



Queenstown Molecular Biology

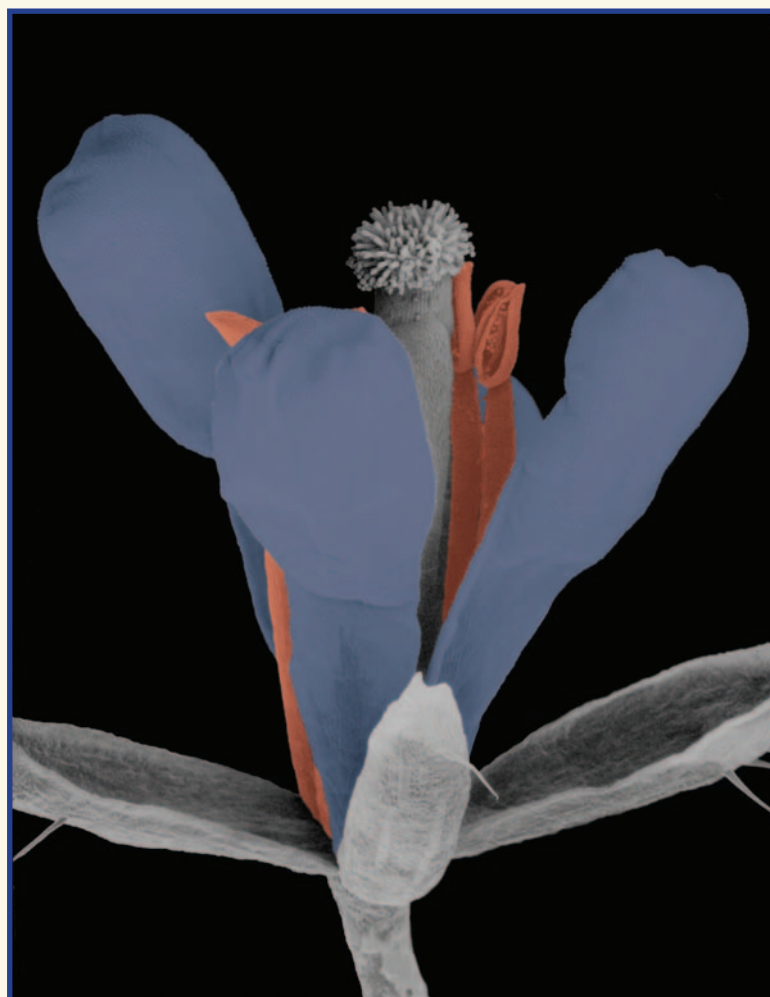
Professor Jeremy Hyams was the convenor of the 2006 Queenstown Molecular Biology Meeting. Despite being smaller than many other conferences, QMB provides a relaxed atmosphere for scientists to talk to each other. The talks themselves this year were exceptionally good and covered a wide variety of topics, ranging from genetics to cell signalling.



Manawatu Science and Technology Fair

IMBS was again a supporter of the Manawatu Science and Technology Fair. Intermediate students (years 7 and 8) from a wide range of schools as well as students from a local secondary schools entered an array of investigations. The winners go through to represent the Manawatu in the *Realise the Dream* competition in December.

The winner of the IMBS prize for 2006 was Mark Zhu (right) from Palmerston North Boys' High School for his project entitled 'War of the Worlds'. At the *Realise the Dream* event Mark was awarded an AgResearch Travel Award. Mark has since been invited to attend the Biofutures Conference in Brisbane.



Picture by Dr Barbara Ambrose

Postgraduates

The IMBS sends its warmest congratulations to those postgraduate students who graduated in 2006.

Degree	2005	2006
PhD	8	6
MSc	14	10
BSc(Hons)	2	5
PGDipSc	2	2
PGCertSc	2	1
DipAppSc	1	0
DipSc	1	0
TOTAL	30	24

PhD

Michelle BRYANT (nee McGILL)

Supervisor: Barry Scott
Title: Functional analysis of the role of fungal hydrolytic enzymes in *Epichloe*-grass interactions
Discipline: Genetics

Gregory CLARK

Supervisor: Michael McManus
Title: Tissue-specific responses to water deficit in the New Zealand xerophytic tussock species *Festuca novae-zealandiae*
Discipline: Plant Biology

Henning KOEHN

Supervisor: Kathryn Stowell
Title: Differentially regulated proteins in breast cancer therapy
Discipline: Biochemistry

Michael LANE

Supervisor: Jasna Rakonjac
Title: Biochemical and molecular characterisation of FliI and FliH from *Helicobacter pylori*
Discipline: Microbiology

Sanjay SAIKIA

Supervisor: Barry Scott and Emily Parker
Title: Functional analysis of *Penicillium paxilli* genes required for biosynthesis of paxilline
Discipline: Biochemistry

Lara SHEPHERD

Supervisor: David Lambert
Title: Ancient DNA studies of the New Zealand avifauna: Evolution, conservation and culture
Discipline: Ecology

MSc First Class

Nicholas ALBERT

Supervisor: Paula Jameson
Title: Light-induced anthocyanin pigmentation in transgenic *Lc Petunia*
Discipline: Plant Biology

Matthew DENTON-GILES

Supervisor: John Clemens
Title: Reproduction in selected New Zealand native ferns and their suitability for revegetation
Discipline: Plant Biology

Hong Ping JIN

Supervisor: Rosie Bradshaw
Title: Further characterization of Dothistromin genes in the fungal forest pathogen *Dothistroma septosporum*
Discipline: Genetics

Sara SCOTT

Supervisor: Jasna Rakonjac
Title: The growth of thermophilic bacteria in a milk powder plant and the formation of spores in biofilms of the dairy thermophile *Anoxybacillus flavithermus*
Discipline: Microbiology

Kelly SENIOR

Supervisor: Kathryn Stowell
Title: Regulation of topoisomerase II alpha expression in humans
Discipline: Biochemistry

2nd Class, Div I

Deborah KNOX

Supervisor: Rosie Bradshaw and Tina Voisey
Title: Identification of transporter genes from the fungal endophyte *Neotyphodium lolii*
Discipline: Plant Biology

Claire MAWSON

Supervisor: Kathryn Stowell
Title: Transcription regulation of human topoisomerase II Beta
Discipline: Biochemistry

2nd Class, Div II

Louise EDWARDS

Supervisor: Al Rowland
Title: Genetic damage in New Zealand Vietnam war veterans
Discipline: Genetics



Stephanie (Alexa) JURY

Supervisor: Paula Jameson
Title: A molecular analysis of flowering in *Metrosideros*
Discipline: Plant Biology

Yuliana YOSAATMADJA

Supervisor: John Tweedie
Title: The regulation of bovine ATP citrate lyase promoter
Discipline: Biochemistry

**BSc (Hons)
First Class****Iain HAY**

Supervisor: Bernd Rehm
Title: Functional analysis of an alginate export protein in *Pseudomonas aeruginosa*
Discipline: Microbiology

Lin LUO

Supervisor: Peter Farley
Title: Molecular cloning and functional characterisation of selected members of a sugar transporter gene family from *Candida albicans*
Discipline: Biochemistry

Charlotte SMITH

Supervisor: Max Scott
Title: Investigation into the function of *Lucilla cuprina white* gene and TurboGFP activity in *Drosophila melanogaster*
Discipline: Genetics

Tracey WALLER

Supervisor: Evelyn Sattlegger
Title: Regulators of the protein kinase GCN2: A contribution to understanding the function of YIH1 and GCN20
Discipline: Molecular Biosciences

2nd Class, Div I**Dharani SONTAM**

Supervisor: Kathryn Stowell
Title: Role of GC elements in the transcriptional regulation of topoisomerase II beta gene
Discipline: Genetics



PGDipSc

Rebecca GRIERSON

Supervisor: Kathryn Stowell

Title: The methylation status of O⁶-methylguanine-DNA methyltransferase promoter of primary melanoma cell lines

Discipline: Biochemistry

Swapna Valli KATTA

Supervisor: Gill Norris

Discipline: Biochemistry

PGCertSc

Zhanhao KONG

Supervisor: Barry Scott

Discipline: Genetics

Postgraduate Programme at Albany

POSTGRADUATE OPPORTUNITIES at the Massey University

BSc Honours
MSc
PhD

INSTITUTE of MOLECULAR BIOSCIENCES AUCKLAND

Colin Schmidt: colin.schmidt@massey.ac.nz
Molecular ecology of plants

Arman Aschraf: arman.aschraf@massey.ac.nz
Translation control

David Lambert: d.lambert@massey.ac.nz
Molecular ecology and evolution

Justin O'Sullivan: j.o.sullivan@massey.ac.nz
DNA topology and gene expression

Evelyn Sattlegger: e.sattlegger@massey.ac.nz
Stress and signal transduction

IMBS
Institute of Molecular Biosciences

For general enquiries contact:
Prof. David Lambert, IMBS, Private Bag 102904, Auckland,
Phone: +64 (0)94 439000 Ext: 41113 Fax: +64 (0)94 418142
d.lambert@massey.ac.nz

IMBS Albany welcomed its first intake into their new Postgraduate Programme in 2006. Eight students were enrolled for degrees varying from PGDipSc to PhD.

Young scientists shine at MacDiarmid Awards

Genetic research that will play a crucial role in the conservation of one of the world's rarest birds was one of two projects by Massey scientists awarded prizes at the prestigious MacDiarmid Young Scientist of the Year awards.

PhD students Damien Fleetwood and Hayley Lawrence were awarded a first-prize category award and a commendation, respectively, at the awards ceremony in Auckland. One of six category winners, Damien received a prize of \$2000.



Organised by the Foundation for Research, Science and Technology, the awards are named after New Zealand-born Nobel Prize winning scientist Professor Alan MacDiarmid and are designed to publicly celebrate the achievements of New Zealand's future leaders in science and to encourage others to follow in their footsteps. Congratulations from Professor MacDiarmid were broadcast at the awards from the University of Pennsylvania, US. Professor MacDiarmid stated that it is vital New Zealand scientists' achievements are honoured and recognised in the same way as those of New Zealand's sportspeople.

The successful scientists were:

Damien Fleetwood, winner of the 'Adding Value to Nature' category, is a PhD student in the Institute of Molecular BioSciences (Palmerston North) but is based at the Crown Research Institute, AgResearch.

Titled 'A Toxic Tag Team', his research explores how fungi and grass combine to poison grazing animals. It focuses on the interaction between grass and the fungus it hosts (the *Epichloë* endophyte) in a relationship Damien describes as a double-edged sword.

"Grass infected with the endophyte is protected from many insect pests but at the same time many strains produce toxic chemicals, including one called ergovaline, that are designed to stop the grass being eaten because they are toxic to grazing stock," he says. Animals that eat endophyte-infected grass producing ergovaline suffer effects ranging from poor weight gain to gangrene and death, at a potential cost of millions of dollars to the agricultural industries each year. Mr Fleetwood's work has helped identify a cluster of six genes that are responsible for producing the toxic chemical ergovaline and built up new knowledge about how they work and when the genes are switched on and off. "Ultimately this will help us maximise the good agricultural effects of endophytes and minimise the bad ones," he says.

Hayley Lawrence, awarded a commendation in the 'Understanding Planet Earth' category, is a PhD student in the Allan Wilson Centre for Molecular Ecology and Evolution at the Auckland campus. She is developing techniques to help locate the burrows of the Chatham Island taiko, one of the world's most endangered seabirds.

It is estimated that there are between 120 and 140 birds remaining, with only 14 breeding pairs on the Chatham Islands. Ms Lawrence's research on the behaviour and interactions of the rare bird in the wild involves the use of taiko (*Magenta petrel*) blood samples that will provide genetic identification for each bird. These genetic identifiers will help researchers track birds to the family nest in underground burrows. When nests are found, improved trapping and poisoning of predators can be carried out to protect the critically endangered species. A predator proof fence has already been built around an area on the Chatham Islands to create a safe breeding ground for taiko.

Hayley says she hopes her project, titled 'Can Whakapapa help save New Zealand's rarest seabird?' will also improve conservation efforts to establish a new colony. Her research is supported by the Department of Conservation.

Grants and Awards

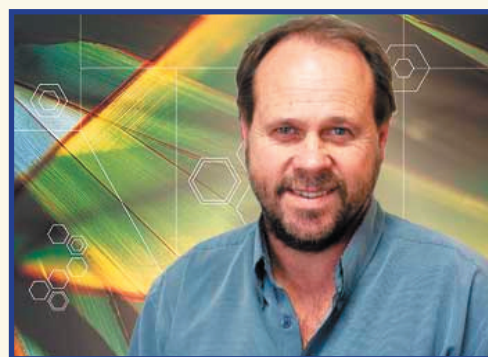
University Research Medals and College of Science Research Awards



Individual

Distinguished Professor David Lambert (IMBS and AWC)

David Lambert is a Distinguished Professor of Molecular Ecology and Evolution and a principal investigator in the Allan Wilson Centre for Molecular Ecology and Evolution – one of the centres of research excellence established by the Government in 2002. Professor Lambert has published more than 130 research papers and made a major contribution to evolutionary genetics.



Most recently, through his work with ancient DNA, he has made news with insights into the taxonomy of the New Zealand moa and the rate of evolution in Adelie penguins.

The award is worth \$20,000.

Supervisor

College of Science: Professor Barry Scott

Since his appointment as Professor of Molecular Genetics at the University in 1985, Professor Barry Scott has supervised 21 PhD, 9 MSc and 11 BSc(Hons)/DipSci students.



2006 Marsden grants



Dr Evelyn Sattlegger and her collaborators from Germany and the USA, will study the function of an enzyme, GCN2, and the protein, GCN1, which activates it. Together, these two proteins allow our cells to know when they are lacking in amino acids and to cope with the problem. Amino acids are particularly important physiologically because, as constituents of proteins, they execute almost all biological functions. Therefore, knowing how cells detect and regulate amino acid levels would be very useful. Dr Sattlegger will determine how GCN2 and GCN1 function in molecular detail, carrying out a variety of genetic and biochemical analyses. In addition to its role in amino acid regulation, GCN2 also plays other specialised but crucial roles in mammals, ranging from behaviour regulation and memory formation, to viral defence and immunological processes. This study could therefore have wide ranging

implications for understanding human health and prevention of disease.

Dr Jan Schmid, from the Institute of Molecular BioSciences, together with Dr Barbara Holland from the Allan Wilson Centre for Molecular Ecology and Evolution and Associate Professor Richard Cannon from the University of Otago, will mate strains of the fungus, *Candida albicans*, to see if sex gives it a survival advantage. *Candida* only reproduces sexually very rarely – it usually just divides in two. It is thought that being able to switch to sexual reproduction could give the species an advantage in certain situations – perhaps it could generate new combinations of genes that make it better at infecting people and more resistant to antifungal drugs, for example. After mating strains, Dr Schmid will test if the offspring are better at surviving than their parents. If they are more hardy, then occasional sex could indeed be giving the fungus an advantage. But if the parents are better at surviving than the offspring, then *Candida* cannot be getting an obvious survival advantage from reproducing in this way, and perhaps sex is a dying art for this species. The study will investigate a fundamental belief: the superiority of sex over reproducing by dividing in two. It could also help in designing treatment for medical conditions caused by *Candida*, by understanding how the fungus evolves.



Dr Leon Huynen, from the IMBS and Allan Wilson Centre for Molecular Ecology and Evolution, will uncover lost secrets of Maori cloaks and kete. Maori cloaks, or kahu, have a long history, and stunning examples exist in museums in New Zealand and around the world. Unfortunately, a lot of the information relating to their origins has been lost, meaning we do not always know when or where they were made, or what materials were used. Dr Huynen and his team will extract and analyse DNA from feathers, skins and plant fibres from cloaks and kete. This will allow them to identify the variety of birds, plants and other animals used, and determine if these have changed through time or varied across the country. The results will also provide information on the preferences and choices made by Maori artisans, for example, were their design and material choices governed by what was available locally, or did they trade feathers,

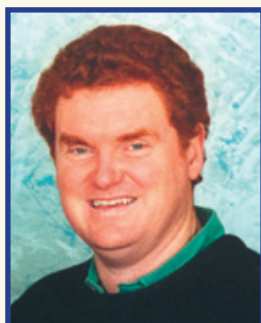
skins and fibre? This project will draw on the DNA database of New Zealand birds to match cloak materials to species, and to specific geographic populations. The research will contribute to the cultural value of these important taonga, by allowing their stories to be told once again. Dr Huynen and his team will work with the support of Te Roopu Raranga Whatu o Aotearoa, the NZ Maori weavers group.

Marsden Fast Start

Dr Armaz Aschrafi, from the Institute of Molecular BioSciences, will study how protein synthesis at the connection points (synapses) of neurons is regulated, which could lead to new insights into how we learn and remember. Localised protein synthesis at synapses is essential for proper connections to be formed between neurons, and if it is not regulated correctly, this can lead to difficulties in learning and memory. An example is Fragile X syndrome, which leads to autism-like behaviours, and difficulties in learning speech.



Massey University Technical Assistance Awards



Dr Max Scott, Institute of Molecular BioSciences, leads a project supported by the Australian wool industry to study gene function in the Australian sheep blowfly. His team is developing a system for making transgenic or genetically modified blowflies, and collaborates with the University of Melbourne who are determining the DNA sequences of fragments of most of the blowfly genes. The genome project will underpin further new projects studying the unique biology of blowflies. Unlike microbes, blowflies cannot be stored frozen, and therefore all flies must be maintained in a labour-intensive regime of feeding (fresh water, protein-rich cookies and fresh liver). The award will fund a technician to assist with this project and with a proposed study of the genes expressed in the salivary glands of blowfly larvae.



Dr Armaz Aschrafi and Dr Evelyn Sattlegger, Institute of Molecular BioSciences, are studying the role of protein synthesis regulators in the formation of long-term memory in the brain. In particular they will focus on the involvement of two translation regulators, IMPACT and GCN2, in the formation of memory.



Nestle Award for Phage Research



The Nestle Award for Phage Research was awarded to Dr Jasna Rakonjac for her paper "Isolation of lactococcal prolate phage-phage recombinants by an enrichment strategy reveals two novel host range determinants" that was published in the Journal of Bacteriology.

IMBS Awards

Applied Biosystems/IMBS Award for Research Excellence - Professor Bernd Rehm

Professor Bernd Rehm is the recipient of the prestigious Applied Biosystems Award for research excellence for 2006.

He is a Professor and Chair of Microbiology within the Institute of Molecular Biosciences at Massey University. Bernd completed his PhD at the Ruhr University of Bochum, Germany, and has held positions at the Universities of British Columbia, and Münster. His research activities are focussed on the microbial production of biodegradable biopolymers such as bioplastics and gel-forming polysaccharides. He is currently investigating how bacterial cells produce these polymers. The understanding of the biosynthetic process enables optimisation and the production of novel tailor-made material for specific applications, such as high-value medical applications. Professor Rehm has more than 80 scientific publications with more than 1000 citations over the last ten years. He is a member of the editorial board of several journals, and also a book editor.



IMBS Outstanding Service Award - Mr Robert Cleaver

Mr Robert Cleaver was awarded the IMBS Outstanding Service Award for 2006. Robert has been a staff member of IMBS and its former departments since 1972. He has worked as technician in many different teaching labs over the years, and for a number of years he was the safety officer for the Microbiology and Genetics Department. He was also the inaugural technician for the DNA Workshop laboratory course. For the past 10 years he has mostly been involved with the 100-level biology of cells and the 100-level biochemistry lab courses. In his spare time Robert is involved in the Palmerston North community as an organist and pianist.



IMBS/Roche General Staff Development Award - Mr Chris Burrows

Mr Chris Burrows was awarded the IMBS/Roche General Staff Development Award for 2006. Chris has been a staff member of IMBS and its former departments since 1987 and beside providing technical support to the third year Biochemistry courses, his duties have included technical support for third year courses in Microbiology, Plant Biology and Cell Biology, participation in the Safety committee, Social committee, Breathing apparatus team, occasional research and the more usual "slave come here and shift this heavy object". This range of experiences will hopefully provide a good background for his latest role, that of Co-Coordinator of Technical Support – Teaching.

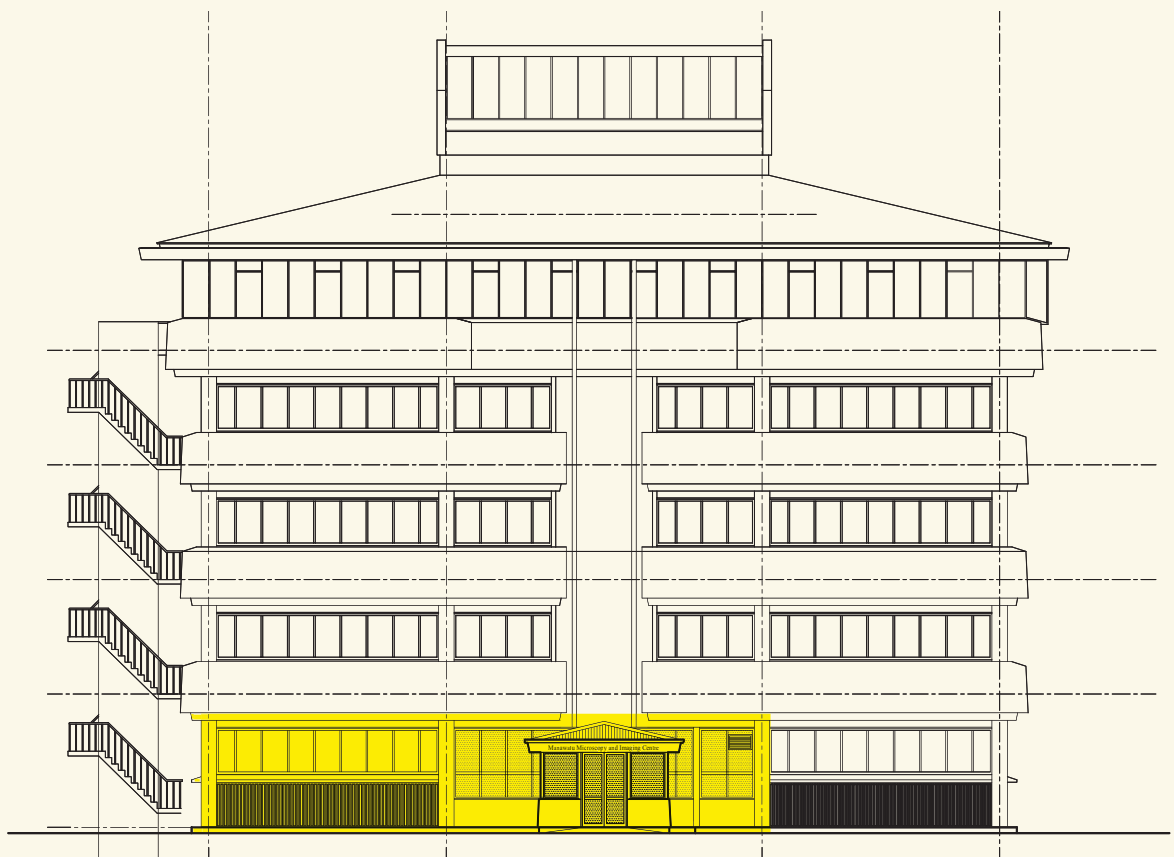


IMBS acknowledges and thanks the sponsors of these awards:

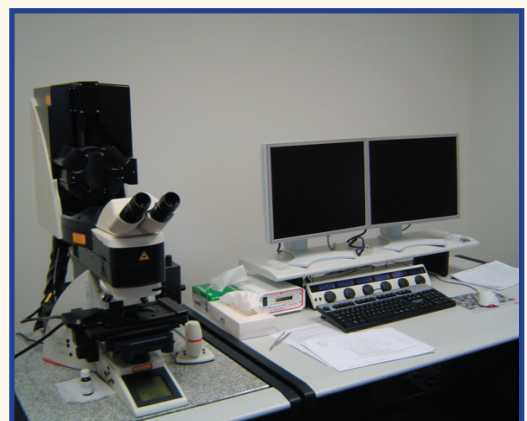


Manawatu Microscopy and Imaging Centre

Following the award of a \$1.58 million grant from the TEC, plans for the Manawatu Microscopy and Imaging Centre (MMIC) were approved in 2006, and the building work is due to start early in 2007. The MMIC, which occupies former undergraduate teaching laboratories on the ground floor of Science Tower D, will house a state of the art confocal facility as well as transmission and scanning electron microscopy.



■ The section of Science Tower D where the MMIC will be housed



From left: transmission and scanning electron microscopes and Leica SP5 confocal light microscope which will form the core equipment of the MMIC

Research Income

Source	Project Title	Academic	Amount
AgResearch Ltd	Mineral nutrition in forage species	Michael McManus	\$20,000
AgResearch Ltd	Ethylene and plant development	Michael McManus	\$37,500
Auckland Medical Research Foundation	Brain Protein IMPACT	Evelyn Sattlegger	\$70,000
Australian & NZ College of Anaesthetists	Pharmacological characterisation of malignant hyperthermia	Kathryn Stowell	\$21,736
C Alma Baker Trust	Chitinase occurrence & induction in camellia flowers	Rosie Bradshaw	\$9,500
Crop & Food Research	Regulation of sulfur assimilation in plants	Michael McManus	\$68,000
Fonterra Co-operative Group Ltd	Probiotics for novel dairy foods	Peter Farley	\$169,912
FRST (AgResearch Ltd)	New opportunities from forage plant genomics: Novel fungal technologies	Jan Schmid	\$160,000
FRST (AgResearch Ltd)	New opportunities from forage plant genomics: Novel fungal technologies	Barry Scott	\$284,444
Health Research Council	Making an IMPACT on brain functions	Evelyn Sattlegger	\$148,900
ISAT Fund	Forest Diseases: A global perspective	Rosie Bradshaw	\$5,190
James Cook Fellowship	Does simple sequence DNA evolve simply?	David Lambert	\$213,333
Massey University PostDoctoral Fellowship Fund	Unlocking the gate of a giant channel	Jasna Rakonjac	\$122,610
Massey University Research Fund	New targets for PNGase research	Gill Norris	\$9,431
Massey University Research Fund	Heart development in yeast	Evelyn Sattlegger	\$5,443
Massey University Research Fund	The molecular basis of maggot therapy	Max Scott	\$6,922
Massey University Research Fund	Structure and function of myostatin	Andrew Sutherland-Smith	\$5,443
Massey University Technician Award	Investigating the role of protein synthesis regulation in the formation of long term memory	Evelyn Sattlegger	\$67,500
Massey University Technician Award	The making of the blowfly	Max Scott	\$70,000
Massey University Technician Award	Gene function in Australian sheep blowfly	Max Scott	\$ 35,000
Maurice & Phyllis Paykel Trust	Translational control conference	Evelyn Sattlegger	\$2,541
Maurice & Phyllis Paykel Trust	Super Regulation: The role of DNA structure in the control of functionally related genes	Justin O'Sullivan	\$12,000
NZ Leather & Shoe Research Association	New products and novel leather manufacturing process	Gill Norris	\$240,000

Source	Project Title	Academic	Amount
NZ Lottery Grants Board	Are locus control regions the masters of our destiny?	Justin O'Sullivan	\$65,836
Palmerston North Medical Research Foundation	Interactions of probiotic bacteria with host	Jasna Rakonjac	\$9,978
Palmerston North Medical Research Foundation	Functional characterisation of <i>Candida albicans</i> hexose kinase family	Peter Farley	\$4,870
Palmerston North Medical Research Foundation	Analysis of the non-dialyzable serum inducer using TLC	Peter Farley	\$4,500
Palmerston North Medical Research Foundation	Dynamain function in fission yeast	Jeremy Hyams	\$10,000
Palmerston North Medical Research Foundation	A Novel regulator of topoisomerase IIa	Kathryn Stowell	\$19,828
Royal Society of New Zealand	Functional analysis of GATA4 mutations on NKX25-5-GATA4	Evelyn Sattlegger	\$10,915
Royal Society of New Zealand	Estimation of evolutionary rates from ancient DNA	David Lambert	\$8,748
Royal Society of New Zealand - Marsden	Kakahu: Revealing the hidden histories of Maori cloaks using DNA	Leon Huynen	\$678,345
Royal Society of New Zealand - Marsden	<i>Candida albicans</i> : Survival without sex	Jan Schmid	\$683,556
Royal Society of New Zealand - Marsden	How do we know that we are hungry? Unravelling the molecular basis of sensing amino acid starvation	Evelyn Sattlegger	\$662,222
TEC BioProtection Core	Signalling in mutualistic symbiosis	Barry Scott	\$359,258
TEC BioProtection Core	Unusual regulation of toxins in plant pathogens	Rosie Bradshaw	\$133,332
			\$4,436,793

Postgraduate Scholarships for 2006

Source	Award	Recipient	Post Graduate Project
Tertiary Education Commission	Top Achiever Doctoral Scholarship	Nick Albert	Regulation of anthocyanin pigment production in <i>Petunia</i>
Tertiary Education Commission	Bright Future Top Achiever Doctoral Scholarship	Angela McGaughran	Determining unique evolutionary patterns for terrestrial invertebrates in Antarctic environments

New Additions

The IMBS family continued to grow in 2006.

Nicola Sutherland-Smith



Nicola (left) was born on the 4 October 2006, weighing in at 2.77kg (just over 6 pounds). This is Andrew and Rosemary's second daughter, a sister to Hannah.

Mina Gagic

Mina (right) was born on the 2 November, weighing in at 3.68 kg. She is Dragana Jankovic's first child.



Kyoko Takemoto

Kyoko (left) is Daigo and Aiko's first child. She was born on Monday 6th November, weighing in at 3.3kg.

Macey Hughes

Macey, Cynthia Charron's baby girl, was born on Saturday 11th November. Macey is Cynthia and Glen's first child.



What is in the wind for 2007

The MMIC opened by the Prime Minister

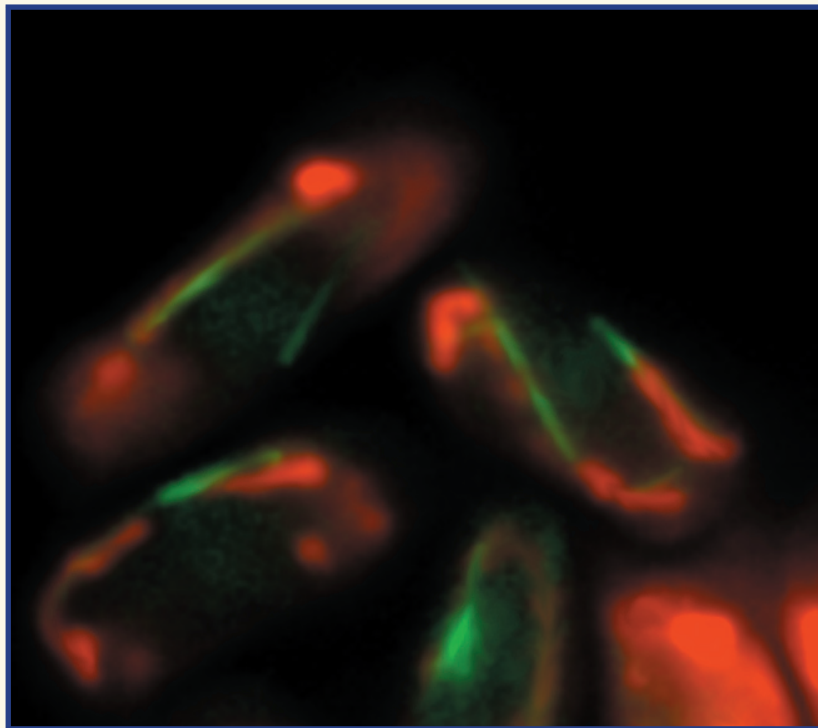
New Professor of Biochemistry appointed

Solexa DNA sequencer purchased and operational

First intake into the new Biological Sciences major at Albany

IMBS staff involved in the launch of the Institute for Advanced Studies at Albany

Royal Society award of James Cook Research Fellowship to Distinguished Professor David Lambert



Fission yeast cells expressing a GFP-tagged α -tubulin (green) to illuminate microtubules and stained with Mitotracker (red) to visualise mitochondria. The interaction between mitochondria and microtubules modifies the behaviour of both cellular components. Image courtesy of Isabelle Jourdain

Institute of Molecular BioSciences
Massey University
Private Bag 11 222
Palmerston North
New Zealand

Phone: (06) 350 5515

Fax: (06) 350 5688

E-mail: imbs@massey.ac.nz

Web: <http://imbs.massey.ac.nz/>



Institute of Molecular BioSciences
Massey University
Private Bag 102 904
North Shore Mail Centre
Auckland

Phone: (09) 414 0800

Fax: (09) 441 8142

E-mail: imbs@massey.ac.nz

Web: <http://imbs.massey.ac.nz/>