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Chemistry

IN NEW ZEALAND

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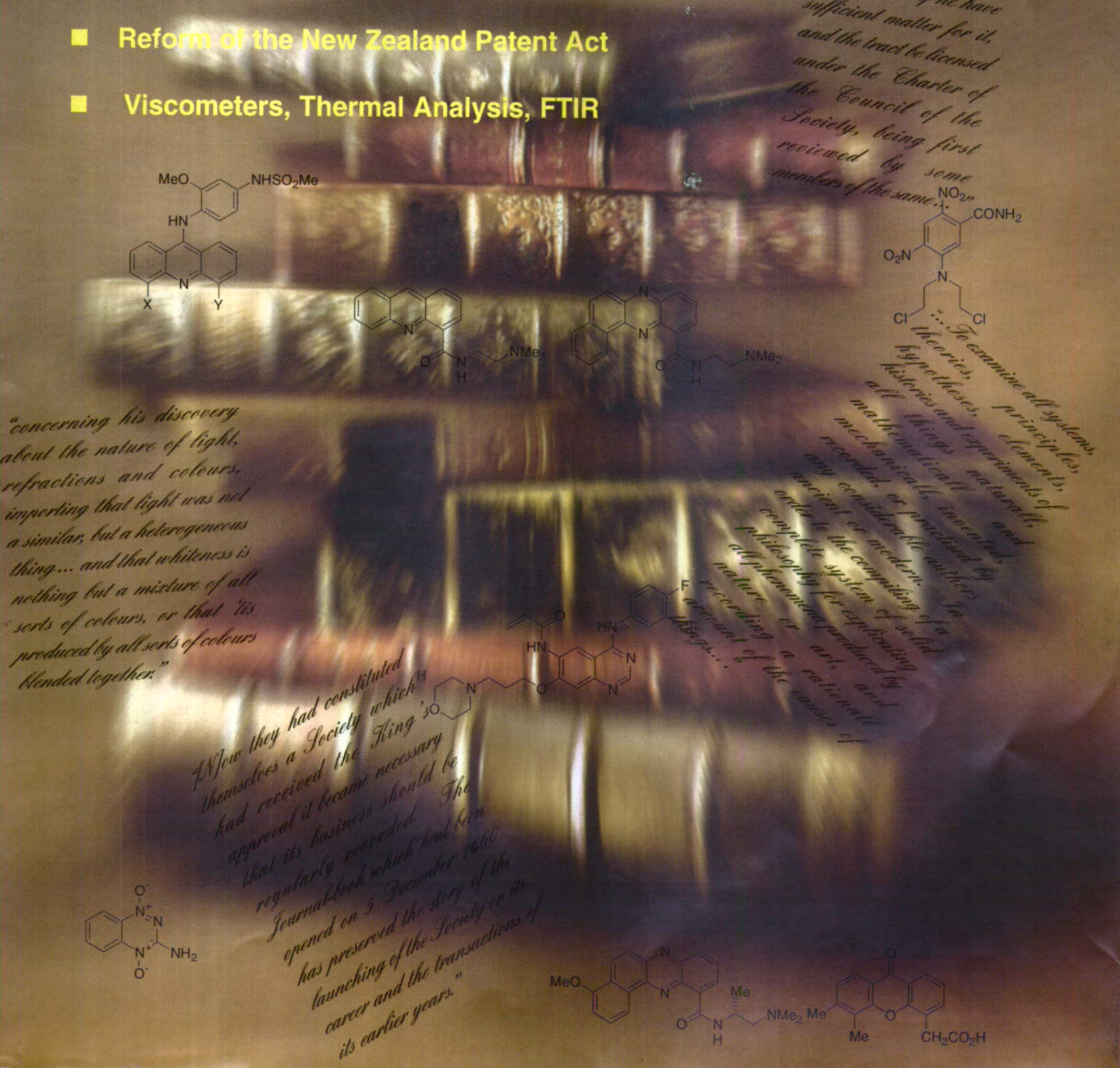
"That the Philosophical Transactions to be composed by Mr Oldenburg, be printed on the first Monday of every month, if he have sufficient matter for it, and the tract be licensed under the Charter of the Council of the Society, being first reviewed by some members of the same."
"... To examine all systems, theories, principles, hypotheses, elements, histories and experiments of all things naturally, mathematically, mechanically invented, recorded, or practised by any considerable authors ancient or modern. In order to the compiling of a complete system of solid philosophy for explicating all phenomena produced by nature or art, and recording a rational account of the causes of things..."
"concerning his discovery about the nature of light, refractions and colours, importing that light was not a similar, but a heterogeneous thing... and that whiteness is nothing but a mixture of all sorts of colours, or that 'tis produced by all sorts of colours blended together."
"[N]ow they had constituted themselves a Society which had received the King's approval it became necessary that its business should be regularly recorded. The Journal-book which had been opened on 5 December 1660 has preserved the story of the launching of the Society on its career and the transactions of its earlier years."
MeO
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In this issue ...

NZ Science Scene

INTELLECTUAL PROPERTY GURU VISITS NEW ZEALAND IN NOVEMBER

A world expert on international law and policy regarding intellectual property and trade will visit New Zealand in November.

Professor Michael Ryan, a distinguished American academic at the Georgetown School of Business in Washington, DC, works at a senior level with many countries to ensure that their intellectual property strategies are focused and aligned with their business and political economies.

He has worked widely in South America, South Africa, Asia, South East Asia and the Middle East.

In addition to this work, Professor Ryan is an outstanding and sought after speaker who regularly provides commentary for radio and television.

While in New Zealand, Professor Ryan will be a plenary speaker at the 8th International Pacific Rim Biotech Conference being held in Auckland from 17-20 November.

He will also be teaching a special one-day Intellectual Property Workshop on 21 November. The workshop is sponsored by BIOTENZ (the NZ biotech industry organisation) and NZBA (the NZ Biotechnology Association).

The workshop will focus on using intellectual property to drive the growth of new businesses; to build and keep competitive advantage; and to leverage capabilities right through the business value chain - from R&D to bio-informatics.

Workshop organiser and BIOTENZ and NZBA Director, Tony Brenton-Rule, says: "We're already seeing strong interest in the workshop from knowledge-based companies.

"Capturing and defending the value of our intellectual property is essential for New Zealand. Professor Ryan has a lot of international experience and know-how that we can learn from.

"Professor Ryan's workshop is strongly recommended to those who have mastered the 'nuts and bolts' of intellectual property and want to move to a much more advanced level."

More information on Professor Ryan can be found at:
www.pacrimbiotechnology.com

For more information on the Pacific Rim Biotech Conference and the Professor Ryan IP Workshop contact:

Avenues Event Management:
Ted Jones
P O Box 10-612,
Wellington
email: ted@avenues.co.nz
Phone: (04) 4998048

NEW NAME AND REPRESENTATIVE FOR BIO-RAD FTIR

Ai Scientific has recently been appointed the official Digilab representative in Australia and New Zealand. Digilab is the new name for Bio-Rad's FT-IR spectrometer systems. The formation of Digilab has given a new focus to the experienced team who have been the leaders in FT-IR spectroscopy for the past thirty years.

Digilab has developed, manufactured and marketed FT-IR instruments for many industries, including pharmaceuticals, polymers, oils, chemicals, cosmetics, art conservation, foods, forensics, semiconductors, as well as academic and hospital research laboratories. With its' headquarters and manufacturing site in Randolph, MA, USA Digilab conducts operations globally in the United Kingdom, Germany, Holland, Japan and the Asia Pacific.

Ai Scientific has significant experience with the Digilab systems having supported the Bio-Rad FTIR range in New Zealand for several years. Digilab users will be fully supported by Ai Scientific's comprehensive Australian/New Zealand service network and a new laboratory that will be staffed by an FTIR specialist providing a professional forum for applications development, training schools and instrument demonstrations.

Contact: Ai Scientific
Freephone 0800 08 60 60
Email: aimail@aiscientific.com

THE UNIVERSITY OF AUCKLAND RESEARCHERS REAP MARSDEN SUCCESS

Twenty-two research projects from The University of Auckland have successfully attracted more than $8.7 million over the next three years from the Marsden Fund's 2002 allocation round. This represents around a quarter of the total funding available. Professor Tom Barnes, Deputy Vice-Chancellor (Research) at The University of Auckland says the latest round of Marsden Fund grants is a welcome boost for the University's researchers. "This is a notable achievement which I believe reflects the excellence of the research community at The University of Auckland," Professor Barnes said. The 22 research projects involve researchers from faculties across the University and cover a diverse range of subjects, including how the brain repairs itself, the writings of Allen Curnow and the abundance of terrestrial planets. "The Marsden Fund has a key role in providing funds for fundamental research across a wide range of disciplines. "The grants carry a great deal of prestige on a domestic and international level and provide the University with the opportunity to make a further contribution to New Zealand's excellent research

reputation," he says. Professor Barnes believes The University of Auckland's success in attracting a large share of the Marsden Grant funding reflects the breadth of the University's expertise and its ability to apply that expertise in multi-disciplinary, basic research projects. The University of Auckland grants also include four Fast-Start awards which are designed to give young researchers an opportunity to initiate and develop research projects.

NEW NATIONAL ASSOCIATION FOR POSTGRADUATE STUDENTS FORMED

Postgraduate students now have a choice of joining a new national organisation to represent their interests.

Groups representing postgraduates from six of New Zealand's eight universities attended a conference last month to discuss the need for a national organisation and hear from the experience of their Australian counterparts. The association plans to look at the issues of quality and resourcing in a bid to improve the level of resources allocated to postgraduates, and will research the issues that post-graduate students are facing. Its formation comes after a recent Government report showed that the level of doctorate students in New Zealand was decreasing. A Ministry of Education briefing paper says New Zealand produces below the OECD average of graduates from advanced research programmes.

A lack of highly qualified researchers - especially in science - could harm the country's global competitiveness, says the research paper, which was released earlier this month. The number of PhD graduates peaked at 476 in 1999. However, in 2000 it fell to 363. Most doctorates were in humanities, followed by biological sciences and then social and behavioural sciences.

For more information contact:
Alistair Shaw
Email: alistair.shaw@vuw.ac.nz
Phone: (04) 4636589

BILLION DOLLAR SAVINGS POSSIBLE FROM CONTROLLING LEAVING AGE

Government plans to ensure all 15 to 19 year olds are in education, training or work by 2006 could save taxpayers more than $1 billion, new British research suggests.

The New Zealand Government is working on introducing an Education and Leaving Age strategy during this term of Parliament that would see all young people involved in education, training or work. It is estimated that up to 10,000 young people are not in the labour force or at school at present. Implementing the Leaving Age strategy will involve building a variety of education, training, and employment pathways and expanding successful programmes like Modern Apprenticeships and Gateway.

Associate Education (Tertiary Education) Minister Steve Maharey said recent British research shows the down-stream cost of having 10,000 young people not in education, employment or training is estimated at £970m. If realised at a similar level in New Zealand, this would equate to savings for the New Zealand taxpayer of well in excess of $1b in long term unemployment, health care, loss of tax revenue and other costs when applied to the at-risk group of young people in this country.

2003 KYOTO PRIZE NOMINATIONS NOW OPEN

The Kyoto Prizes are awarded to individuals or groups worldwide who have contributed significantly to scientific progress, cultural advances and human betterment in three categories of Advanced Technology, Basic Sciences, and Arts and Philosophy. The Royal Society is now seeking suitable candidates who it can nominate for the 2003 Kyoto Prize in Basic Sciences in the field of Earth and Planetary Sciences, Astronomy and Astrophysics. For copies of the guidelines and application forms please contact Eddie Davis at the Royal Society.
Email: eddie.davis@rsnz.org
Applications close 31 October 2002.

DR GAVIN FISHER ELECTED CLEAN AIR SOCIETY PRESIDENT

Dr Gavin Fisher, a Senior Air Quality Scientist with NIWA and Director of the National Centre for Climate-Energy Solutions, was elected overall President of the Clean Air Society of Australia and New Zealand on 22 August 2002. This is the first time a New Zealander has been made President. Dr Fisher previously held the position of New Zealand Branch President.

PASTURE PLANT RESEARCH TO BENEFIT FROM COLLABORATION

Research into the structures of proteins from pasture plants will benefit from the appointment of Dr Vic Arcus to head The University of Auckland's and AgResearch's collaborative structural biology laboratory.

Dr Arcus's appointment is the first under a partnership agreement that the University and the Crown Research Institute signed earlier this year, aimed at strengthening national capability in life sciences research and education. The collaboration brings together AgResearch's active gene discovery programme with the University's structural biology programme, New Zealand's leading research facility for protein structure determination.

Dr Arcus says that x-ray crystallography will be used to study protein structures, initially in ryegrass and white clover, to see how they function and interact.

ANTARCTIC SCHOLARSHIPS

1. Sanford, Sealord and Amaltal Scholarship
This scholarship is valued at $10,000 per annum and is intended for a

Masters or PhD student to undertake work on stock assessment and biology of Patagonian Toothfish or associated species, or related projects in the fishing environment in the Ross Sea. The successful applicant will potentially be able to conduct research and sampling during one of the Southern Ocean fishing expeditions.

2. Ministry of Foreign Affairs and Trade Ross Dependency Scholarship
This is a one-year scholarship for Masters or PhD degrees valued at $5000 to undertake research at Gateway Antarctica concerning a matter of importance to the understanding of Antarctica or the Southern Ocean.

The deadline for applications for both scholarships is 1 October 2002. For further details contact Susannah Hawtin, Gateway Antarctica
Phone: (03) 364 2136
Email: gateway@anta.canterbury.ac.nz

MORST DIALOGUE FUND

Earlier this year the Minister of Research, Science and Technology set up a fund of $450,000 per year to support the development of programmes to engage citizens in discussion over science-related issues that are causing tension between science and society. Nominations were called for a strategy group to advise MoRST on how to achieve the best outcomes for the Fund including:

- Advice on drawing up the Request for Proposals for the pilot programmes.
- How to assess the effectiveness of the pilot programmes and how to get this feedback to the science community.
- Advice on training needs to allow the science community to use dialogue processes
- How the media may play a role in the dialogue process.

The Advisory Group members are:
Will Allen: Landcare Research
Tim Barnard: Forest Research
Neels Botha: AgResearch
Wendy Boyce: Environment Waikato
Andrea Graves: Liggins Institute
Jack Heinemann: University of Canterbury
David Johnston: Institute of Geological and Nuclear Sciences
Ian Kennedy: National Science and Technology Roadshow Trust
Andrew Matthews: NIWA
Malcolm Menzies: Victoria Link
Annie Perkins: Groundworks Associates
John Quinn: NIWA
Paula Reeves: NIWA
Anthony Scott: Association of Crown Research Institutes
Ian Shaw: ESR

This group met last month and developed a strategy for the fund and guidelines for the type of projects that will be considered for funding. MoRST will now prepare the call for applications which will be notified in mid-October. Further information contact: richard.meylan@morst.govt.nz
Internet: http://www.morst.govt.nz/society/index.html

NEW COMPANION OF THE ROYAL SOCIETY ELECTED

At its recent Council meeting in July, the Royal Society of New Zealand acknowledged the achievement of one of the country's passionate advocates for science and technology by electing him as a Companion.

Dr Jonathan Hickford of Lincoln University has been awarded the honour in recognition of his contribution to the promotion and encouragement of science and technology in New Zealand.

Science promotion has always been a major activity of the Royal Society but, unlike research, which has been encouraged and honoured by the Fellowship, promoting science did not have formal recognition in the Society structure until 1997. The 1997 legislation, which defines the Royal Society's functions, provides for the class of membership to recognise achievements and encourage activities in the advocacy of science and technology. There are currently 12 Companions of the Royal Society of New Zealand.

R.H.T. BATES POSTGRADUATE SCHOLARSHIP - REMINDER

Applications are now being called for the 2003 R.H.T. Bates Postgraduate Scholarship This scholarship was established by the Royal Society of New Zealand in memory of Professor Richard Bates FRSNZ.

The scholarship, tenable at any New Zealand university for one year, is available to graduates who are registered for the degree of Doctor of Philosophy. Students in the physical sciences and engineering will be eligible, with preference being given to those whose research aims to apply information/image processing to studies in medicine, the physical sciences, astronomy or engineering.

Applications close on 25 October 2002. For further information, see: http://www.rsnz.org/awards/academy_awards/bates.php

PROFESSOR TIMOTHY PEDLEY RUTHERFORD LECTURE TOUR 2003

The Rutherford Memorial Lecture was established in 1952 by the Royal Society (London) as part of the Rutherford Memorial Scheme. Since then, in association with the Royal Society of New Zealand, triennial visits have taken place to this country to present the Rutherford Memorial Lecture.

Professor Timothy Pedley, FRS, G.I. Taylor Professor of Fluid Dynamics at Cambridge University, and Editor for the *Journal of Fluid Mechanics* has accepted the invitation to deliver the 2003 Rutherford Lecture in New Zealand in mid to late July 2003. The Royal Society hopes to organise lectures at Branch meetings in several cities.

Chemistry@Massey

Carol Taylor and Andrew Brodie
Chemistry - Institute of Fundamental Sciences, Massey University, Private Bag 11-222, Palmerston North

This year Massey University is celebrating its 75th Anniversary and, as part of this occasion, its chemistry alumni gathered for a reunion from 4 to 6 July 2002. Although chemistry has been a major in the BSc degree for just over 30 years, the discipline itself has played an important role in the life of Massey for a much longer period.

The Development of Chemistry at Massey

Massey Agricultural College opened its doors to students in 1928 and within a year Mr F. L. C. Scrivener, BSc(Agric), from Wye College (UK), was appointed to a lectureship in soil chemistry and Mr B. L. Elphick, BSc(Hons, Chem.) (London), an Assistant Lecturer in Chemistry.

One assumes these men would have been involved in teaching the second year *Advanced Chemistry* paper which all students enrolled in the Bachelor of Agricultural Science degree were required to take. And one of the options for third year BAgrSc students listed 3 compulsory papers (of the 10) with a strong chemistry component:

- Physiological Chemistry, Animal Nutrition and Dairy Chemistry
- Plant Bio-Chemistry and Chemistry of Farm Crops
- Chemistry of Soils, Fertilisers, Manures and Sprays

The fee for each of these papers was £3-10-0 with a reduction of 10/- per subject if paid within 3 weeks of the beginning of the course concerned!

Scrivener and Elphick would not have taught first year chemistry even though students enrolled for the BAgriSc were required to take two chemistry papers in their first year. They had to complete this year at one of the four New Zealand University Colleges but, in 1958, the Massey College introduced first year science teaching, including chemistry, which meant the entire degree could be completed at Massey.

Above: An early laboratory class, Main Building, *ca.* 1930. (Massey Archives).

The close association of the College and the former New Zealand Research Institute meant that often staff held joint appointments and when the laboratories were completed in the Main Building they worked there. By 1930 for example, F. H. McDowall MSc(NZ), DSc(London), a lecturer in Dairy Chemistry, was one such person. McDowall was an organic chemist whose research included investigations on the properties of cheese as well as the chemistry of milk.

Eventually the Department of Agricultural Biochemistry was formed under the leadership of C. R. Barnicoat in the early sixties. This Department was headed by Dr Clem Hawke a biochemist. The others in the Department at that time were Dr Ted Richards, an organic chemist, Dr Robert Brooks, an analytical chemist and a demonstrator, Eileen Coxhead. Ross Grimmett was an assistant lecturer, who in 1965, became Massey University's first PhD graduate in chemistry, having been supervised by Ted Richards. Another chemist, Garth Wallace, had moved to the Department of Food Technology. Clem Hawke continued as Head of the Department of Chemistry and Biochemistry (formed in 1963) and the second chemistry PhD graduate, Colin Boswell, arrived as a Junior Lecturer during this year to carry out research under Robert Brooks.

Massey University is Established

In 1964, after Massey was designated as a university, Dick Batt, the newly appointed Professor of Biochemistry, arrived to head the Department and lead a period of rapid expansion of staff and student numbers. Third year chemistry papers were first taught in 1967 hence allowing Massey University's first chemistry graduates, Susan Metcalf and David Giltrap, to complete their BSc degrees by the end of that year. The Department moved from the Main Building to the new the Science Towers at the end of 1968 and chemistry got is first professor with the arrival in 1969 of Geoff Malcolm as Professor of Physical Chemistry. In 1970 Stephen Kent and Owen Mills graduated MSc in chemistry and the first (fourth year) BSc(Hons) students (Stewart Gumbley, Alistair MacGibbon, Rex Humphrey and Alan Furness) successfully completed their degrees in 1971.

Apart from a brief period, when it incorporated Physics, the department was known as the Department of Chemistry, Biochemistry and Biophysics, and it carried on with the same title as teaching and research facilities expanded. An important development occurred in 1995 when Dr John Harrison moved north to start teaching first year chemistry at Massey University Albany. There were no laboratories at first so he had to run the classes in the evening at the nearby Kristin School. In 1996, the Department was split and chemistry became a separate Department under the headship of Professor Andrew Brodie. But this was short

lived, for in 1998, as part of a major reorganisation of the University's academic units, it was incorporated, along with mathematics and physics, into the Institute of Fundamental Sciences.

The Centre for Structural Biology, led by Professor Geoff Jameson, spans this Institute and the neighbouring Institute of Molecular Biosciences thus helping to maintain our important links with biochemistry. The Nanomaterials Research Centre, headed by Professor David Officer, was opened in 2001 by New Zealand's Nobel Laureate, Professor Alan MacDiarmid.

The Reunion

The festivities started with a Trivial Pursuits Evening that was held jointly with the Manawatu Branch of the New Zealand Institute of Chemistry who provided generous sponsorship. The Quizmaster, Trevor Kitson, divided those present into three teams: *The Phosgenes*, *The Butyrics*, and *The Polymers*. And the questions began to flow ... ranging from chemical knowledge to a who's who of the Department over the years, and some questions which belonged in a cryptic crossword, *e.g.*, "The name of which chemical sounds rather like the entry fee for a public convenience after dark?" Answer: uranyl nitrate.

Seventy questions, a few drinks, and much hilarity later, the teams were asked to gamble their points on one last question: list all the elements which begin with the letter "S" - there are nine! The ultimate winners were *The Phosgenes*, although *The Butyrics* felt that this result was more a consequence of their opponents' strategy than of a sustained performance during the evening.

Above: Alistair Bingham and Geoff Malcolm. (photo credit Andrew Brodie).

About 70 people attended the more formal part of the reunion that swung into action the next day. The College of Sciences, Pro-Vice-Chancellor, Robert Anderson, spoke briefly on the strengths of Chemistry@Massey and opened the proceedings. Massey's chemical magician, Eric Ainscough started things off with a bang—simultaneously igniting three hydrogen-filled balloons in close proximity to our front row of dignitaries, which included the Chancellor and members of Council.

Above: Rose Motion and Gill Norris. (photo credit Andrew Brodie).

The symposium was divided into three sessions and the speakers were chosen in an attempt to represent past and present staff and students and a range of chemical topics. They were as follows: Emily Parker, *Enzymes: The Chemistry of Life*; Robert Norris, *My Life as a Fonterran*; Wayne Campbell, *From Spark Plugs to Solar Cells*; Ted Baker, *Life at the Interface Between Chemistry & Biology*; Darren Englebretsen, *Meanderings of a Kiwi Peptide Chemist*; Amy Watson, *Synthesis of a Monophosphonic Acid Analogue of 3,5-Dihydroxyphthalic Acid*; Adrian Jull, *Chymist, Chymist, Burning Bright*; Geoff Jameson, *Adventures in Science*; Craig Steed, *The Teaching of Chemistry in Today's Secondary Schools* and John Harrison, *Go That Way*! Photos and memorabilia were on display in the foyer outside the lecture theatre where morning and afternoon tea were served.

Left: Aaron Dobbs and Graeme Lyon. (photo credit Massey News).

In the late afternoon, visitors were taken on a tour through the teaching and research laboratories, ending in the 100-level chemistry laboratory where they were given a preview of activities being developed for sixth form students. Alumni could not believe the changes that have occurred in the refurbished Tower A.

The after-dinner speaker at the reunion dinner was Professor Geoff Malcolm. Ken Jolley introduced Geoff with his "Tale of Four Professors." Young Ken had developed some interesting impressions of "professors" before coming to New Zealand in 1968 where he was fortunate to meet his fourth chemistry professor – Geoff Malcolm. Ken then paid tribute to Geoff's role in building Chemistry@Massey. In his talk, Geoff looked back on the evolution of Chemistry@Massey and offered some sage words of advice on how to maintain our strong reputation and values. He emphasized four qualities that he believed served chemistry at Massey so well in its initial growth and development, and will continue to serve it well if staff

and students remain faithful to them. These qualities are: willingness to adopt a humble and supportive role towards the applied sciences, collegiality among staff, commitment to students, and dedication in research.

Above: Phillip Tse, Graeme Lyon, Ian Andrew and Elaine Ireland touring chemistry research facilities. (photo credit Grant Platt).

Above: Kimmo Wiltshire in the Structural Biology Unit. (photo credit Grant Platt).

Above: Mother and daughter – Debbie and Amy Ballantyne at the dinner. (photo credit Andrew Brodie).

Above: Andy Nicholson and Mike Boland at the dinner. (photo credit Andrew Brodie).

Following dessert there were some less formal "reminiscences" from which a newcomer gleaned the following:

- The Massey silver collection includes a silver trowel, which was used to lay the foundation stone of the University of Auckland. Professor Dick Batt once defended Massey's possession of this artefact rigorously.

- Ken Jolley was once voted the staff member female students would most like to be stuck in a lift with (there was some debate over whether the venue was a lift or a log cabin).

- Robert Brooks was once blessed by the Pope.

The festivities continued for a small group on Saturday morning, with a tour of the campus by history student, Rachael Bell. The staff club – Wharerata – provided a final lunch.

The reunion was a resounding success, summed up by the following comments from one attendee: "Very much enjoyed the weekend, especially the dinner Friday night (the reminiscences) and the walk around the campus on Saturday. I have now been to three universities (life is a continuous process of learning!) and Massey has something unique which makes it stand out from the others."

Keeping in contact

Chemistry@Massey intends to stay in touch with its alumni and to help us do this an internet site has been set up at http://ifs.massey.ac.nz/index.shtml

If you are one of our alumni and we have not yet managed to contact you then we would be pleased if you would complete the form that is available at this site.

NEWS

Membership Survey 2002 - Results

A survey of NZIC members was carried out using a mail-back questionnaire that was distributed with the March 2002 issue of *Chemistry in New Zealand* (Volume 66 No. 1). The principal aim of the survey was to elicit information from members as to their perceptions of current and potential future benefits of NZIC membership. It is important for the future of the Institute that Council takes into account, as far as possible, the wishes of members as to the services and benefits to be obtained from membership. The survey was timely in view of the effort being put into resuscitating the journal and improving the NZIC web site.

Some 88 responses were received (*ca.* 10% of membership) and a preliminary summary of the results is presented in Table 1 and expressed as the percentage responding to each specific category. This simple analysis ignores interactions, for example the obvious one that older members tended to give a higher rating to discounted health insurance. The median age group was 50-60 years and occupational groups were spread quite widely – the IP category was added. Overall the results are likely to be skewed by the high proportion of older and retired members responding, but there are still some interesting trends.

There were generally enthusiastic responses to the questions on current benefits. The issue of professional recognition was somewhat bipolar with academics generally rating it lowly and consultants highly. One strong comment was *"Journal/meetings are too academic and run for the benefit of university staff members only. Unless these issues are addressed NZIC is "dead in the water" compared to IPENZ, ACANZ and other vibrant, active technical bodies. NZIC lives in the past"*. This comment does draw attention to some key issues, although the IPENZ approach of registered professionals is not enforceable without legislation. The high support for the *Journal* validates the increased effort being put into maintaining it. *CHEM NZ* also attracted several favourable comments. The salary survey (not actually annual) did not receive very much support and this service might need review. Feelings were ambivalent about Branch meetings and the biennial conference. However, the percentage of high responses to these questions represents more than enough members to support these on-going activities, and there were many respondents who rated these benefits the highest.

The questions on potential new benefits were generally not well supported [>50% with no response (NR) or low rating], although a few identified strongly with some of them. There was enough support for joint subscriptions with RACI, RSC, or ACS to make some approaches to these organisations worthwhile. For journals, the best avenue may be to seek discounts through agencies such as Science Direct for on-line access. Discounts on scientific software would also appear worth looking into. The insurance questions raise the interesting question of whether insurers would regard chemists in bulk as a good risk. The enthusiasm from the older membership for discounts in this area and also consumer services should be looked into as this group tends to receive lesser benefits from the journal, meetings and conference.

The revamped NZIC website received favourable comment from many respondents and there was good enthusiasm for several of the new options. Electronic access to the journal would need some password access or late posting (say after 6 months) to protect the privileges of paying members. This option and that for *CHEM NZ* may not be difficult to organize. Similarly, more links to other science sites will be easy to set up. Please email the URLs and brief supporting comments for your favourite sites to: webmaster@nzic.org.nz

We will review the ideas and introduce an additional links page. We will also review how we can set-up science-specific links to on-line employment agencies. A page for our scholarships and prizes would also be worthwhile. One respondent also asked for lists of past recipients, which is a good suggestion. An additional service requested in survey comments and independently is a printed membership list. This will be implemented in the near future provided privacy and technical issues can be resolved.

Overall the survey revealed good levels of support for most of our traditional activities and much enthusiasm for more on-line information. The challenges are to capture on-line benefits for our members, retain the interest and loyalty of our older members, and develop a mix of measures that ensure professional/technical credibility to attract younger members. Additional comments are welcomed on the survey, the responses, and the issues raised.

Please mail any comments to:
Hon. Gen. Secretary, NZIC, Freepost 39283, Howick, Auckland, or Email: secretary@nzic.org.nz

Mercury Metal Available

If anyone is interested in mercury metal, at a very low price, please contact:
John Little, Technical Manager
Department of Chemistry
University of Waikato
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Table 1. **NZIC Members Survey 2002 - Distributions of the 88 Responses[a]**

Age:

20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	>70	NR
8%	10%	18%	30%	13%	13%	9%

Highest Qualification:

NZCS	Dip. Sci	BSc	BSc(Hons)	MSc	PhD	DSc	Other
1	1	11	8	20	51	6	1

Current Area of Occupation:

High School Teacher	Tertiary Academic	Research Inst. Science Staff	Science Mgt.	Company Lab.	Company Mgt.	Student
2%	19%	11%	5%	8%	10%	5%
Reg. Gov.	Central Gov.	Consultant	Retired	I.P.	Other:	
1%	2%	10%	23%	2%	1%	

Rank current benefits to you of NZIC membership:	**NR**	**1**	**2**	**3**	**4**	**5**
Professional recognition	6%	9%	13%	31%	22%	20%
Journal - *Chemistry in New Zealand*	3%	2%	6%	28%	45%	15%
Annual Salary Survey	10%	24%	32%	22%	11%	1%
Branch meetings	11%	15%	15%	22%	22%	16%
Biennial national conference	11%	30%	23%	16%	9%	11%
Comments on NZIC benefits	81%	0%	0%	0%	0%	19%

Rank potential new benefits of NZIC membership:	**NR**	**1**	**2**	**3**	**4**	**5**
Reduced RACI sub to receive RACI journal	17%	36%	15%	20%	9%	3%
Reduced RSC sub to receive partial benefits	16%	37%	11%	15%	13%	8%
Reduced ACS sub to receive partial benefits	18%	37%	8%	16%	11%	9%
Joint sub with NZSBMB	17%	43%	16%	15%	6%	3%
Discounts on personal sub'n to *Australian J. Chem.*	21%	44%	21%	9%	5%	1%
Others journals?: *RSC, ACS, VCH, AOAC*	67%	23%	5%	1%	2%	2%
Discounts for on-line journals	21%	30%	9%	17%	16%	7%
Discounts on scientific software	20%	28%	13%	20%	8%	13%
Discount on personal liability insurance	26%	37%	10%	11%	9%	6%
Discount on personal health or life insurance	24%	26%	15%	18%	8%	8%
Discounts on other consumer services	26%	24%	9%	29%	10%	1%

How important are the following current or potential new NZIC website features likely to be to you in the future?	**NR**	**1**	**2**	**3**	**4**	**5**
Electronic access to ChemNZ and CiNZ articles	13%	14%	10%	34%	21%	8%
More links to other scientific web sites and services	13%	13%	6%	24%	34%	10%
Current job vacancies, including Post-doc positions	18%	25%	13%	18%	14%	11%
Scholarships and prizes	23%	30%	14%	13%	13%	8%
Email hosting and FAQ service	21%	22%	10%	24%	18%	5%
Other web based activities? - Comments	90%	0%	0%	0%	0%	10%

[a]NR – No response; 1 = low priority; 5 = high priority

PATENT RESEARCH PENDING

The Royal Society of London has launched an investigation into whether the use of laws that encourage the commercial exploitation of scientific research is helping or hindering progress in fields such as genetics and computing. The study has been set up in response to concerns about how best to protect the ownership of inventions, through patents for instance, while preserving a free exchange of ideas and knowledge between researchers. Some scientists believe that a better balance is required between creating incentives for industry and commerce to exploit research, and realising the maximum benefit to society of the work of scientists.

AUDITOR'S REPORT

THE NEW ZEALAND INSTITUTE OF CHEMISTRY CHEMICAL EDUCATION TRUST

I have examined the books and records of the Chemical Education Trust of the New Zealand Institute of Chemistry for the year ended 31 March 2002.

In common with other organisations of a similar nature, control over income prior to its being recorded is limited and there are no practical audit procedures to determine the effect of this limited control. Subject to the possible effect of the limited control over income referred to in the preceding paragraph, in my opinion the financial statements give a true and fair view, under the historical cost basis, of the financial position of the Trust as at 31 March 2002 and of the results of its activities for the year ended on that date.

(signed)
R J Furkert, Hon. Auditor

NEW ZEALAND INSTITUTE OF CHEMISTRY CHEMICAL EDUCATION TRUST

INCOME/EXPENDITURE TO 31 MARCH 2002

			01/02	00/01
Income				
Interest:	Cheque	$25		
	Call	$108		
	Kiwi Nest	$1680		
	Term Deposit	$856	$2,669	$2,817
Equiticorp			$8,532	-
	Total Income		$11,201	$2,817
Expenditure				
Grants			$2,609	
Net Income			**$8,592**	**$2,817**

BALANCE SHEET AS AT 31 MARCH 2002

Trust Funds		
Opening Balance	$56,784	$53,967
Net Income	$8,592	$2,817
	$65,376	**$56,784**
Represented by:		
Current Assets		
BNZ Cheque Account	$830	$10,805
BNZ Call Account	$5,029	$416
Investments		
Kiwi Nest Egg	$30,615	$28,935
Term Deposit	$28,902	$16,628
	$65,376	**$56,784**

B. Halton
Treasurer – Trustee
7 May 2002

International Union of Pure and Applied Chemistry

IUPAC

announces the 2003

IUPAC Prize for Young Chemists

The IUPAC Prize for Young Chemists has been established to encourage **outstanding young research scientists** at the beginning of their careers. The prize will be given for the **most outstanding PhD thesis** in the general area of the **chemical sciences**, as described in a 1000-word essay.

Prize USD 1,000 and travel to the IUPAC Congress in Ottawa, Canada August 2003

Each awardee will be invited to present a poster on his/her research and to participate in a plenary award session.

Call for Nominations
(deadline February 1, 2003)

For more information, including application form, please visit the IUPAC Web site at **www.iupac.org/news/prize.html** or contact the IUPAC Secretariat by Email at secretariat@iupac.org or by Fax: +1-919-4858706

NZIC Conference 2003

First Announcement

Plans are well underway for the 2003 NZIC Conference that is to be held in sunny Nelson in the first week of December 2003. We have a great venue lined up at the Rutherford Hotel, details of which can be found at: http://www.rutherfordhotel.co.nz/

The committee is starting to work on the program and more information will follow soon. For now, we can let you know that **Dieter Seebach** (ETH), **David Fairlie** (Queensland), **Chris Abell** (Cambridge) and **Craig Hawker** (IBM) have agreed to present plenary lectures.

Please mark November 30 - December 4, 2003 in your diary now!

Andrew Abell
Chair, 2003 NZIC Conference Committee
University of Canterbury

NZIC Branch News

AUCKLAND

On Thursday 22 August 2002, the Banch hosted a Chemistry Careers evening. The evening was intended to provide undergraduates and graduate students with an overview of career options for a tertiary chemistry qualification.

The speakers included **Michelle Sullivan** from the Health Research Council of New Zealand, **Mark Paton** from the intellectual property law firm Baldwin Shelston Waters, **Gary Strange** from Douglas Pharmaceuticals, **Ian Graves** from Lion Breweries, **Matt Templeton** from HortResearch, **Robert Winchester** from ESR, **James Andersen** from Westlake Boys' High School, and **Tony Crane** from the Careers and Employment Centre at the University of Auckland.

The evening commenced with pizzas in the Chemistry Department Common Room, followed by entertaining and informative insights into their chosen careers from all the speakers. The Branch thanks the speakers for their time and effort, which was very much appreciated by the attendees and it will discuss the possibility of a Careers Evening becoming an annual or biennial event.

2002 Auckland Chemistry Scholar of the Year
Sixty students from twenty-six Auckland schools tested their theoretical and practical chemistry knowledge at the 2002 Auckland Chemistry Scholar of the Year Competition, held on September 5 at the University of Auckland's Chemistry Department. After an hour long test and two laboratory sessions, students took a breather with lunch and a lecture on green chemistry before finalists were announced and a rapid-fire quiz was held to determine the final place-getters.

Competition was extremely close between the top four students – only 6 points from a total of 152 separated them but first place went to **Richard Yu** (Kings College), second place to **Lydia Chan** (Westlake Girls High School), third place to **Peter Lau** (Mount Roskill Grammar), and forth place to **Samadhi Wimalasena** (Westlake Girls High School)

CANTERBURY

Mixing chemistry and social activity has proven a winner for Branch meetings in recent months.
Continuing our association with the Outreach Program, the NZIC Branch hosted the presentation of a new Outreach Seminar at the May meeting. This was held at the University of Canterbury Engineering Department and was very well attended, attracting many local teachers. An engineering student, **Stuart Harris**, presented the talk on the World Trade Centre collapse from the engineering perspective. A tour of some of the engineering facilities and description of some current research projects of the department followed the presentation.

Continued support for the "Outreach" programme of the Chemistry Department is one of the major projects of the Branch. However, it really has been a two-way street as the Outreach programme works closely with the local committee and helps out with the NZIC Branch meetings. **Rebecca Hurrell**, who runs the Outreach programme, has particularly close contact with all the schools in our area and through her we are able to keep them up-to-date with branch activities. Taking advantage of the presence in Christchurch (attending the IUPAC 14th International Conference on Organic Synthesis), of **Paul Anastas**, from the White House Office of Science and Technology Policy, and **John Warner**, from the University of Boston - Massachusetts, Rebecca organised a "Green Chemistry" workshop which was well attended by many high school teachers, and both staff and students of the Chemistry Department. The attendees were very impressed with the day. We look forward to many more collaborations with the Outreach programme and we intend to write in more depth about its work in future issues.

The inaugural annual *Trivia and Truffles* evening was a raving success in June and should see many already in training for next year's competition! A total of ten teams competed for the recognition as the top trivial chemists of the night. The co-hosts and organisers **Rebecca Hurrell** and **Michael Edmonds** delivered their well-researched questions with aplomb. The winning team, Two Pussycats and the Owl comprising **Bryce Williamson, Alan Happer** and **Cassandra Hinton** were well refreshed for their efforts, receiving bottles of wine donated by the Christchurch Polytechnic (Seven Oaks). As an example of the session, a few sample questions from the evening were:

What was the solution for killing Triffids?
Answer: Seawater/salt water.

Marie Curie's daughter also won a Nobel prize. In which category? Answer: Chemistry.

Name a Beatles song title that contains a plastic.
Answer: Polythene Pam.

Who made the following statement "Chemistry is a trade for people without enough imagination to be physicists."?
Answer: Arthur C. Clarke

Name a Christmas song that mentions an element.
Answer: Silver bells

In the movie, The Rock, *what substance does Nicolas Cage have to inject himself with?* Answer: Adrenalin

The selection of truffles was also very popular. These highly nutritious titbits came courtesy of the recipe book of Jan Wikaira and the expert culinary skills of the

Committee. Thank you to everyone who competed or supported a team. It was good to see participation from so many different organisations, including many students keen to display their talents. We also thank our sponsors, Christchurch Polytech (Seven Oaks Wine), the University Bookshop (Book Vouchers), and Café 101 (Coffee Vouchers), who provided prizes for the night.

In July we presented *The Chemistry of Bubbles - Wine Tasting* with **Kirsten Munro**. This very successful night was attended by a full house of 32 fizz fans that had the opportunity to try some 10 different varieties of sparkling wine with an expert and entertaining commentary from Kirsten. The wine selection was diverse according to geography as well as finance – and no, the Bollinger was not the universal favourite! Kirsten kept us informed about the winemaking processes for each bottle, as well as the chemical components of the bubble creation process. The audience included people from the University of Canterbury Chemistry Department, Landcare Research, WRONZ, ESR, AgResearch, Crop and Food, an Erskine visitor, and Merino NZ.

The August meeting, the NZIC Presidential Address by **Dr Patrick Holland** on *"Endocrine Active Substances in the Environment"*, took place after this material was submitted.

On August 25-26 the Canterbury Branch will once again be supporting the Canterbury Westland Science Fair. The Fair provides an avenue for school students (aged 9 to 13 years) to exercise and display their interest in science through a project or poster. The NZIC will be sponsoring two prizes for exhibits showing the best understanding of Chemistry with two representatives of the Branch acting as judges.

On September 10 we will be staging *"The Chemistry of Fireworks"* with **Antony Leland** from Fireworks Professionals. This will involve a talk on the chemistry involved in fireworks, accompanied by an indoor demonstration. The evening will be publicised to high schools and we hope to attract large numbers of students.

Supporting Young Chemists: Chemistry Olympiad
The NZIC has traditionally supported the attendance of New Zealand students at the International Chemistry Olympiad. This is an international competition (held this year in the Netherlands) on chemistry knowledge and practical ability amongst high school students. This year the NZIC Branches were asked to provide support in their own region if it was being represented, and the Canterbury Branch Committee was unanimous in wanting to do so. The region had a strong presence in the Olympiad this year, with a local student, **Gemma Mason** (Burnside High School), having been selected as part of the four-person team. **Robert MacLagan** from the University of Canterbury was also involved as one of the two-team mentors – see elsewhere in this issue for a report on the 2002 Chemistry Olympiad. The Branch drew on travel funds to provide $500 for the Olympiad and supplemented this by running a raffle (in association with the Trivia and Truffles night) from which we raised a further $210. We thank those members who showed their support through the purchase of tickets, and also our sponsor, UBS, who contributed toward prizes.

The Olympiad was held in the Netherlands in June. The New Zealand team won three Bronze Medals and an Honourable Mention. We are hoping that Gemma will give a brief presentation to a future Branch meeting.

University of Canterbury
Jim Coxon and **Andrew Abell** have finalised details of a bioactives project which will receive $1.3 million over three years to carry out research on the prevention of cataracts. Partners in this project will include workers at Lincoln University, Douglas Pharmaceuticals (NZ), and Senju Pharmaceuticals (Japan). **Leon Phillips** has been successful with an NSF cooperative research proposal on which he is associate investigator. The proposal, which was initiated by **Professor Barbara Finlayson-Pitts** Chemistry Department, University of California – Irvine), will be funded to the extent of US$500,000 per year for five years, beginning around 1 July 2002. Only 5 of 70 proposals in this special category (cooperative proposals involving international collaborations) were successful. The title of the project is *"An integrated approach to understanding the air-water interface in atmospherically relevant systems"*. It will involve four other Irvine faculty members (two chemists, a physicist and a mechanical engineer) as well as **Dr Pavel Jungwirth** of the Czech Academy of Sciences. Amongst other things, the grant will fund exchanges of students and faculty between Canterbury and Irvine. Professor Finlayson-Pitts is a co-investigator on Professor Phillips' current Marsden proposal (Processes at the gas-liquid interface) the fate of which will be known in early September.

New Postdoctoral Fellow
Paula Brooksby who comes from Otago via UC Davis has begun work with **Dr Alison Downard**.

Overseas Visitors
Neus Domingo (Department Física Fonamental, University of Barcelona) spent four weeks in the Department conducting experiments with **Bryce Williamson** into the application of MCD to measurements of the magnetisation of molecular (nano-) magnets. **Professor Jane Nelson** (Queens University, Belfast) visited in August as an Erskine Fellow and taught a course on inorganic spectroscopy to CHEM 461. **Professor Peter Gill** (University of Nottingham) has accepted a Fellowship for the period 14 July to 31 August 2003. Peter will be teaching quantum chemistry to CHEM 363.

14th International Conference on Organic Synthesis (ICOS)
This was held at the Christchurch Convention Centre in July under the auspices of the International Union of Pure and Applied Chemistry (see elsewhere in this issue for a conference report). On the last day of the conference **Professor Paul Anastas** from the White House Office of Science and Technology Policy and **ProfessorJohn Warner** from the University of Massachusetts Boston held a one-day workshop on Green Chemistry (see: http://www.epa.gov/greenchemistry).

Dr Paul Anastas, from the White House Office of Science and Technology, has accepted a Visiting Erskine Fellowship for the period 16 September to 13 October 2002. Paul's main specialist fields are green chemistry and science policy. He will be presenting a course on green chemistry to CHEM464 (Contemporary Issues) and a giving number of seminars.

MANAWATU

The Manawatu Branch has hosted three meetings recently. On June 25, **Paul Haddad**, University of Tasmania, who is the 2001 Royal Society of Chemistry Australasian Lecturer, spoke on the relatively new technique of *Capillary Electrochomatography* and its potential applications. The Branch joined with the Massey University chemists who were having a reunion of their graduates on July 4 for a *Trivial Pursuits Evening* (a report of the reunion is given elsewhere in this issue). The Branch's annual *Careers in Chemistry* lunch function for chemistry students was held on July 31 with **Harry Percival** presenting NZIC prizes to **Greer Rivers** from UCOL (Environmental Analytical Chemistry Level 6) and Massey student **Melanie Willingham** (300-level biochemistry). **Adrian Chaplin** and **Ross Knudsen** shared the 300-level chemistry prize. The speakers at the event were **Lucy Meagher** (AgResearch), **Jo-anna Hislop** (New Zealand Pharmaceuticals Ltd), **Patricia Shields** (Massey University) and **William Kersten** (Palmerston North Boys' High School). All spoke with enthusiasm about the value of their chemistry degrees in their careers and how they continued to add value to their first qualifications through ongoing study and training.

Landcare Research

Benny Theng has recently returned from 6 months leave at the Centre de Recherche sur la Matiere Divisee (CRMD), CNRS in Orleans, France. He was there to help compile a *Handbook of Clay Science* together with **Dr F. Bergaya** (CRMD-CNRS, France) and **Professor G. Lagaly** (University of Kiel, Germany). Leading experts from many countries will contribute written material to the handbook that is to be published by Elsevier Science. Benny hopes to go back to Orleans for 3-4 months in early 2003 in order to assist with reviewing and editing the manuscripts.

Massey University

Richard Haverkamp, of the Institute of Technology and Engineering (and the Branch Chairman) has been promoted to Associate Professor. Richard is awaiting the arrival of his new AFM instrument that has been funded as a result of his association with the Alan MacDiarmid Institute of Advanced Materials and Nanotechnology. **David Officer**, Director of the Nanomaterials Research Centre, has been promoted to a chair in chemistry and **Geoff Jameson**, Director of the Structural Biology Unit, to a chair in Structural Chemistry and Biology. **Andrew Brodie** was recently elected to the RSNZ Council representing the Physical Sciences and Technologies.

Tony Wright has won one of the inaugural Tertiary Teaching Excellence Awards. The awards, worth $20,000 each, recognise excellence in tertiary teaching, promote good teaching practice, and enhance career development for tertiary teachers. Eleven awards were presented to fourteen recipients, as well as a supreme Prime Ministers' award. Forty-four nominations for the awards were received from tertiary institutions ranging from universities, polytechnics, and private training establishments. Massey University Acting Vice-Chancellor, **Professor Graeme Fraser,** says the award is an outstanding achievement by Dr Wright. Tony says when he began his university career he was a driven researcher. Now researching what makes a good teacher equally drives him. "I love research and I love teaching. Now I find the two are intertwined as I look at what makes people learn chemistry and what it means to them."

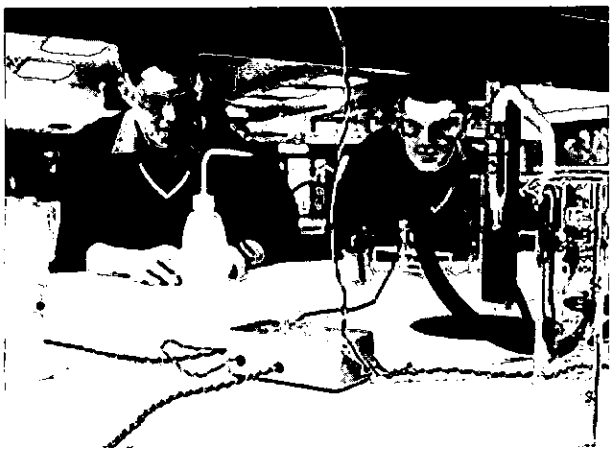
Above: Tony Wright enthusing students with chemistry. (Photo credit: Massey News).

New arrivals in chemistry include **Julie Locke**, who is on a Marsden postdoctoral fellowship working with **Carol Taylor**. Julie is from the University of Western Sydney. **Susan Habas**, a PhD student from University of California at Berkeley, and a Fulbright Scholar, is spending time working in the Nanomaterials Research Centre.

A major new initiative in chemistry at Massey has got off to a great start. Chemistry staff are working with chemistry teachers to facilitate a hands-on experience for students that will support chemistry teachers in their delivery of the Year 12 curriculum. The experiments involve students in either extracting an essential oil from citrus fruit, or making a conducting plastic. These tasks provide a link between their everyday experiences and the research strengths in chemistry at Massey in biological chemistry and nanomaterials. "Not only do students make something they can take home, but they also get a glimpse of chemistry as the vibrant active discipline that it is," says **Adrian Jull**, the leader of the team developing the initiative. "One of the major aims of the visit is to facilitate the transition between high school and university by giving students an experience of learning in a university setting," he says. By the end of the year, 35 schools and around 1000 students will participate in the programme. The positive response of students, teachers, and chemistry staff at Massey University means that this programme will be on again next year.

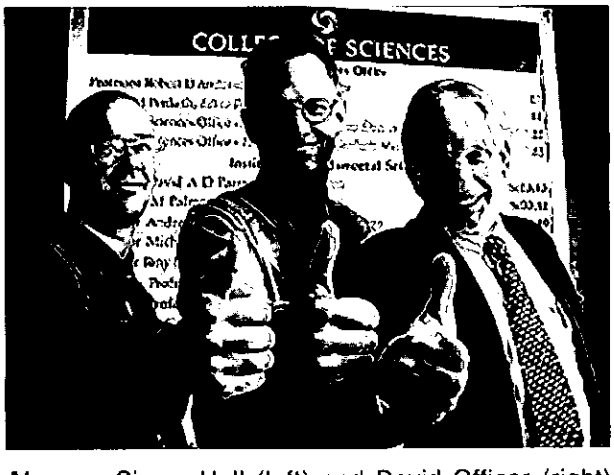
The Nanomaterials Research Centre has formed a partnership with Nobel Prize winner **Professor Alan MacDiarmid**. **Professor David Officer** says the man known as the 'father of conducting polymers' will become an adjunct professor at Massey University and spend

several weeks here each year working with the staff at the Centre. "Together we are developing joint projects with Professor MacDiarmid and the University of Philadelphia as part of our relationship with the MacDiarmid Institute for Advanced Materials and Nanotechnology, based at Victoria University."



Above: Carlos Salvador and Matt Angland of Palmerston North Boys' High School make conducting polymers. (Photo credit: Massey News).

A project to build cheaper and more efficient solar cells and batteries will receive $3.87 million over the next four years from the Foundation of Research Science and Technology. Led by **Professor David Officer**, the project will develop advanced materials for energy technology. David says this is the first time a project of this type and breadth has been funded by FoRST. The team, including **Simon Hall, Richard Haverkamp, Keith Gordon** (University of Otago), along with **Dr Tony Burrell** (Los Alamos) and **Dr Gordon Wallace** (Wollongong), is developing integrated solar harvesting and storage technologies. These include existing titanium dioxide solar cells and nickel-zinc batteries developed at Massey University by Dr Hall's PhD student **Michael Liu.** Michael has just successfully defended his PhD research and is continuing to work on the project.



Above: Simon Hall (left) and David Officer (right) celebrating their $3.87 million grant. (Photo credit: Massey News).

Recently **Julian Adams** successfully defended his PhD dissertation "*Studies in Protein Structure. The structures of β-lactoglobulin in two new crystal forms. The structure and properties of the iron superoxide dismutase from Methanobacterium thermoautotrophicum*". Julian succeeded in obtaining the structure of β-lactoglobulin at low salt conditions, finding that the structure is little changed from high-salt, non-physiological conditions, thereby dispelling lingering criticisms about the relevance of X-ray structures to properties of β-lactoglobulin in milk. He also contributed to emerging ideas on the role of entropy in stabilising protein structure. His work on the atypical iron superoxide dismutase provides clearer understanding of how iron and manganese superoxide dismutases are optimised for function within a common structural framework, despite the large intrinsic differences in the chemistry of Fe^{3+}/Fe^{2+} and Mn^{3+}/Mn^{2+} redox couples. Julian is now on a postdoctoral fellowship with **Michael Parker** and **Bruce Kemp** at St Vincent's Hospital, Melbourne, Australia. His supervisor, **Geoff Jameson**, says, "We will miss Julian greatly for his unfailing enthusiasm and helpfulness to all, as well as for his contributions to research."

OTAGO

The annual NZIC analytical competition at the Otago Branch was held on August 30. This year about 30 students attended from schools in Dunedin as well as Oamaru, Palmerston, and Taieri. The competition centered on the analysis of carbonates and was organized by **Jon Kim**. **Margaret Mills** assisted in encouraging schools to participate.

Keith Gordon attended the International Conference on the Science and Technology of Synthetic Metals (ICSM) held in Shanghai, China in early July. The conference covered a wide range of topics, from organic light-emitting diodes through to spectroelectrochemistry of polymers. Keith is on the local organizing committee for the next ICSM, which is to be held in 2002 in Wollongong. Keith was part of a group of scientists, led by **Professor Paul Callaghan** (Victoria University), that were successful in attracting Centre of Research Excellence (CoRE) funding through the establishment of the MacDiamird Institute for Advanced Materials and Nanotechnology. Keith's contribution will focus on the spectroscopy and modelling of new functional materials, such as nanotubes and conducting polymers.

Pat Holland, President of NZIC, visited Otago on August 22. He gave a fascinating talk to the local branch on endocrine disrupting chemicals—what they are, how they work, and whether or not their low concentrations in the environment are cause for concern.

On May 3, 40 intrepid chemists, foodies (food scientists) and partners from Dunedin, took to State Highway One in a motley collection of cars and vans on a wild ride South. Shaking and cold after some harrowing buffeting and with the drivers complaining of nervous exhaustion from battling the storms, we were assembled by **Arthur Ballantyne** and divided into groups for talks and tours of Back Country Foods, Deep South Ice Cream and Gladvale Chicken. Later, at the Ascot, we were treated to nibbles and a talk by **Evan Penniall** from Kayes Bakery. The trip then turned social for the rest of the evening, celebrating

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Otago's win over Auckland in the Super 12 and visiting the local bars. Saturday's attraction, the Bluff Seafood Festival, was changed to Invercargill due to the weather. The Festival was immensely enjoyed by all before facing the floods and winds in a slow grind back home.

The Branch sponsored two recent national events. Our contribution to the New Zealand International Science Festival, held in Dunedin at the end of June, was *"Dr Al's Chemical Mayhem"*, a chemical "magic" show that drew a large audience of young and old. The Branch also donated prize money to the Senior Schools Science Quiz, a national quiz for school pupils at Year 11, 12 and 13 levels, run by the Division of Sciences at the University of Otago.

WAIKATO

Contrary to what was stated in the last issue of *Chemistry in New Zealand*, we are delighted to report that **Dr Richard Coll** elected not to accept the position at the Institute for the Advancement of University Learning at the University of Oxford and is still among us as a Branch committee member.

The Orica Chemnet prize is awarded to the best first year chemistry student, at the University of Waikato who continues on to study chemistry at level 2. For 2001, two students, **Kim Evans** and **Sarah Devoy**, both had excellent and indistinguishable academic records, but fortunately Orica Chemnet very generously provided two prizes of $300. The Department of Chemistry has a number of connections with Orica Chemnet, located in Mount Maunganui. These links include collaborative research projects and the Company has often hosted BSc(Technology) students for their work placements.

Above: Kim Evans(centre) and Sarah Devoy (right) receiving their prizes from Orica Chemnet Research and Technology Manager Dr Stephen Tredwell.

The annual Waikato Branch Analytical Chemistry competition was held on Thursday 20 June. Invitations were sent to schools in the Waikato/Bay of Plenty region to send teams of four students to the University for the day to carry out an analysis. A total of 19 teams entered this year, with students coming from as far afield as Katikati.

The task was to analyse nickel sulfate employing a gravimetric procedure for Ni^{2+} and a titration for SO_4^{2-}. This was quite a demanding task in the time available but some excellent results were achieved. Most of the students presented reports that would rank alongside those expected of a good first-year University student. Although judging was difficult, the following prizes were awarded:
1st Prize: A combined team from Sacred Heart Girls College (**Ingrid Beckers, Elizabeth Honey** and **Hyun-Jin Lee**) and Ngaruawahia High School (**Amy Hagan**).
2nd Prize: St Pauls Collegiate (**Aaron Harrison, Ross Paterson, Joe Cursons** and **Nicholas Woosley**)
3rd Prize: Katikati College (**Richard Boyes, Kirstin Taylor, Lance Surgenor,** and **Cameron Scrace**)
4th Prize: Melville High School (**Zainab Mubarak, Nico Johnston, Amy Chau** and **David Campbell**)
5th Prize: Tauranga Boys College (**James Rae, Michael Borrie, Andrew Suh** and **Adam Richardson**)
Numerous people contributed to the success of the occasion:
Annie Barker in particular for setting up the laboratories, assisted by **Wendy Jackson** and **Amu Upreti**.
Michèle Prinsep and **Natalie Curnow** for the prize certificates.
Lyndsay Main, Derek Smith and **Michael Mucalo** for supervising the laboratories.
Tui Doak of Bryant Halls for the excellent lunches.

All-important financial support is acknowledged with thanks: Hill Laboratories for generously sponsoring the prizes, NZIC Waikato Branch for funding the lunches, and Chemistry Department, University of Waikato for facilities and staff time.

Overall the competition enabled keen 7th form chemists to spend a day in the University laboratories and mix with peers from other schools, and provided an opportunity for the teachers who accompanied the students to meet each other and with University chemists.

As part of the Waikato TechnoFest, the NZIC and the Chemistry Department of the University of Waikato organised a public Chemistry Magic show. This was presented by **Professor Brian Nicholson**, with **Wade Mace, Susanna Thwaite, Wendy Jackson** and **Annie Barker** as main assistant alchemists. The show attracted over 300 people, ranging in age from toddlers to **Sir Don Llewellyn**, who enjoyed the series of demonstrations, especially those that didn't go completely according to plan! (liquid nitrogen makes a good emergency fire-extinguisher....). The NZIC sponsored 100 T-shirts with the "Chemistry, it's magic" logo on, which were in strong demand from the audience.

Over the last few months **Dr Doug Wright** has been talking to a variety of groups about Ernest Rutherford. This arose out of a request from the Friends of the Waikato Musuem to provide some background to the Rutherford Centenerary exhibition that was in Hamilton earlier this year. Doug has more recently had a triple by-pass operation and we wish him a speedy recovery.

Local Non-University News

DEC International NZ Ltd

The FDA has granted approval for a controlled-release pharmaceutical product that has been developed and manufactured in Hamilton. DEC International NZ Ltd., which is based in Hamilton, recently became the first New Zealand Veterinary Pharmaceutical Company to have a new animal drug product approved for sale on the US market by the US Food and Drug Administration.

The CIDR insert manufactured by DEC International NZ Ltd., in Hamilton is a controlled-release insert developed in New Zealand for the control of oestrus in cattle. The product has been designed to release a constant amount of drug per day over a 7-day treatment period. The outside skin of the insert is made of inert silicone rubber impregnated with naturally occurring progesterone hormone.

The FDA is the gatekeeper to the most important market in the world for pharmaceuticals, the USA, and approval by the FDA is mandatory to be able to market a pharmaceutical product in the US. FDA approval is regarded by the rest of the world as the gold seal for safety, purity and efficacy of a pharmaceutical product.

Dr Shane Burggraaf said the US registration process has been a challenging learning experience for all those involved. FDA approval for the CIDR product took over 4 years to complete and cost in excess of $NZ 3 million. It is expected that US approval will lead to at least a 200% increase in growth for the company.

WELLINGTON

The June meeting of the Branch was addressed by the 2001 Royal Society of Chemistry Australasian Visiting Lecturer, **Professor Paul Haddad** from the Australian Centre for Research on Separation Science, at the University of Tasmania in Hobart. His topic was *"Capillary Electrochromatography: The New Wave in Separation Science?"*

Professor Haddad's group leads the development of this technique - a combination of capillary electrophoresis and liquid chromatography. The method involves the separation of ionic species in a fine capillary that contains a stationary phase. The whole is under the influence of a strong electric field and the ionic species are detected optically. By varying the stationary phase the separation selectivity can be fine-tuned to effect normally difficult separations. By using in-line pre-concentration, the sensitivity can be enhanced to give detection limits at the sub-PPM level.

Professor Haddad concluded by answering the question in his title. This technique has advantages of simplicity, separation efficiency, and sensitivity when compared with the usual technique for analysis of ionic species, namely ion chromatography. However, for most routine applications ion chromatography is still probably the method of choice.

In July the Branch was addressed by **Professor John Spencer** (School of Chemical & Physical Sciences, Victoria University) as a somewhat belated Branch Chairman's address (John was Chairman for the past three years). His topic was *"Magic Metals: Catalysis with Transition Metals"* and included the development of metal catalysis, from Davy's observation in 1817 (that finely divided platinum would ignite coal gas) to the sophisticated catalysts that permit the stereoselective polymerisations of olefins, or enatioselective hydrogenations, and are central to many commercially important reactions. He described some recent work in his group on hydrido compounds, and presented demonstrations of catalysis ranging from a working model of Dobereiner's match (featuring platinum catalysed ignition of hydrogen generated in a Kipp's-like apparatus, a commercial hit in the 1820s, though somewhat cumbersome compared with a "Bic" lighter) to the preparation of polyacetylene.

The last meeting, that in August, was held at Indusrial Research Ltd, Gracefield, and the speaker was **Dr Tim Kemmett** of the Inorganic Materials Section of IRL. He spoke on the topic *"Self-cleaning windows, non-fogging mirrors and other magic tricks"*. Tim described how surface coatings of titanium dioxide could be formed on glass or ceramic surfaces by calcining films of complexes of titanium tetra-isopropoxide formed with solutions of various di-, tri-, and polyols. The resulting anatase is a semiconductor and, when exposed to near-ultraviolet light, electron/hole pairs are formed, which persist for several hours. These have the ability to catalyse the oxidation of organic material—hence the self-cleaning surfaces—and to react with water to form super-"hydrophelicitous" surfaces on which water condenses as a film rather than as droplets—hence the non-fogging mirrors. Tim described a number of complexes whose structures that have been determined by X-ray crystallography and formed by titanium tetra-isopropoxide with chelating alcohols.

The 2002 NIWA Wellington Regional Science Fair ran from August 21 to 24 and was again held at Victoria University. The approximately 380 entries were on display in the laboratories of the School of Chemical and Physical Sciences at Victoria University. There were many extremely interesting entries, and most exhibitors had gone to a great deal of trouble in preparing their presentations. However, the number of entries based on chemistry themes was relatively low, but these were of a very high standard.

The Wellington Branch of NZIC has sponsored the event for many years and the 2002 prizewinners were:

Senior Section:

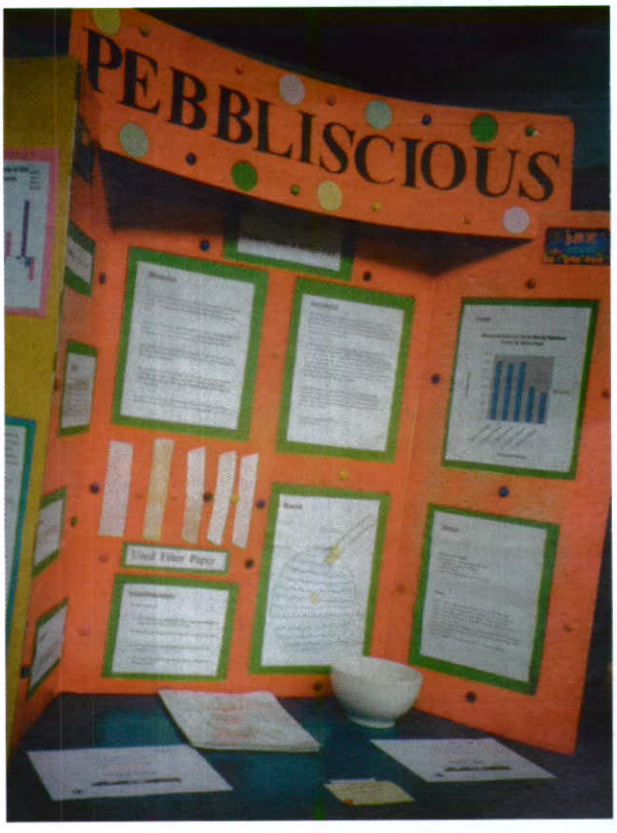
"Fishing for O_2 in Water"

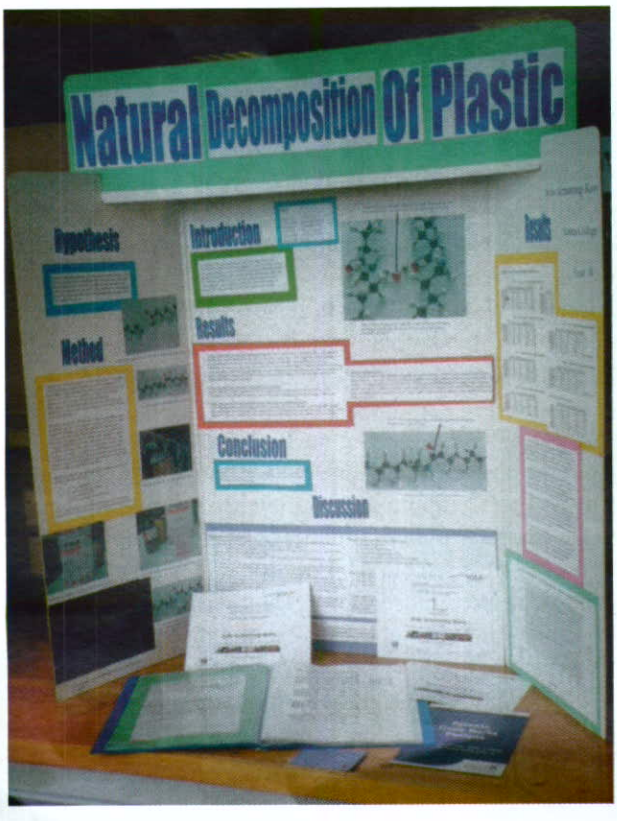
Justine Baker and **Naomi Eastwood-Wilshere** (Sacred Heart College)

Junior Section (Joint Winners):

"Pebbliscious" **Bridget Ford** and **Victoria Taylor** (Queen Margaret College)

"Natural Decomposition of Plastic" **Arlo Armstrong-Kooy** (Aoeta College).





Above: Wellington Science Fair Junior Section winning displays (Photo credit: Neil Curtis).

This year's judges were Rob Keyzers and Alan Turner.

Wednesday August 29 saw the Branch annual titration competition and quiz night for local college pupils. The titration competition, which requires the nomination of entrants from a given school, involved the majority of the local colleges, and provided an opportunity for a demonstration of practical skills. However, it was the ability to perform the vital calculations that separated the winners. The winners were:

Joint First: **Rita Jivan** (Wellington East Girls College) and **Ashanth Phillips** (Scots College).

Second Equal: **Stuart Cross** (Upper Hutt College) and **Kate Newton** (Queen Margaret College).

The fourth annual NZIC Chemistry Quiz for sixth and seventh form college students followed this in the evening at Victoria University. As previously, the number of teams had increased this time to forty, each of four students, and they represented 14 schools from the Wellington and Wairarapa regions. The large numbers dictated a change in venue and the Student Union Hall, was used.

The college students really enjoyed themselves, even if some of the diabolical chemistry questions presented by the quizmasters, PhD students **Laine Cousins** and **Rob Keyzers**, had them stumped. The night consisted of a series of five rounds of questions interspersed with spot prize questions and two pages of pictures that required naming in nominal "free time". One of the sheets comprised pictures of common laboratory glassware, the other, five famous scientists. A highlight of the evening was from the Wairarapa College team who named **Dr David Weatherburn**, a Victoria University academic, as Harry Potter and "annotated" the picture to prove it!

Above: The Wellington Quiz Night (Photo credit; Thomas Borrmann).

Above: Upper Hutt College team (Photo credit; Thomas Borrmann).

At the end of the evening a winning team had to be found and, for the first time in the history of the quiz, two teams tied for first! They were the **"Periodikals"** from Scots

College, Wellington, and **"*o*-Peroxy-*p*-methoxytrinitrobenaldehyde"** from Hutt Valley High. In third place were **"Professor Whizzo and the Chemists of Death"** also from Scots College. In what appears to be a regularly occurring theme, the "Periodikals" from Scots College was the Sixth Form team (with a fifth former included) and they beat their Seventh Form peers!

***Above: "Periodikals"** (Scots College) and **"o-Peroxy-p-methoxytrinitrobenaldehyde"** (Hutt Valley High) (Photo credit; Thomas Borrmann).*

The Branch thanks the organisers, **Laine Cousins** and **Rob Keyzers**, their team of infamous "Happy Helpers" - **William Pitchforth, Kate Lunn, Lucy McCabe, Duncan Henry, Andy McFarlane, Kirsten Edgar, Steven Haylett-Petty, Steven Mackey, Joanna Wojnar, Paula Wightman, Rhys Batchelor** and **Thomas Borrman.** Thanks also go to the Science Faculty of Victoria University, McDonalds (Lambton Quay) for assisting with resources for the event and **George Taggart** of the Student Union for providing the venue.

BRANZ

Dr Larry Jordan has won the 2002 BRANZ Study Award. He plans to spend four weeks (from October) at the University of Wales at Bangor, working with their team on biocomposites, as well as attending a conference on this topic.

Cawthron Institute

Paul McNabb and **Pat Holland** attended the 4th Molluscan Shellfish Safety Conference in Santaigo, Spain in June and advanced the case for use of their LC-MS methods in monitoring of marine biotoxins. This technology is a significant advance over the currently used mouse bioassays.

Doug Mountfort has recently returned from the Biotech Institute, University of Cambridge, after working with **Dr Lisa Hall** for two months to develop biosensor for the detection of marine biotoxins in seawater. The work successfully mobilised a key enzyme onto Sepharose beads, and a portable prototype employing the bead system is in the design phase for further testing. **Claire Debarnot** from Montpelier, France has returned home after a completing a 6-month degree project on biosensor developments with Doug at Cawthron.

Veronica Beuzenberg has accepted a MoRST Technical Participation Programme Fellowship to assist her visit to the NRC Marine Biosciences Laboratory, Halifax, Canada, and attend the October HAB conference in Florida as part of her research with **Lincoln Mackenzie** into hazardous algal blooms.

Dr Pat Holland, 2002 NZIC President, visited Canterbury and Otago Branches in August and gave his lecture *"Endocrine Active Substances in the Environment"*. He will be visiting North Island branches during September.

Industrial Research Ltd

Ian Brown (Materials Technology) has been appointed Maori Science Co-ordinator for Industrial Research. **Cara Dunford** has recently moved from the Biomaterials team to the Materials Technology group; she is still primarily working in the same research area, namely optical characterisation of organic materials with potential for use as optical switches and in solid-state dye lasers.

Mark Waterland has been constructing the team website for the Materials Technologies Group at IRL <http://www.irl.cri.nz/mat-tech-group>. The site gives a good overview of the group's work on advanced materials at IRL. He visited Massey University on August 14 to meet the IFS chemistry faculty and gave a talk entitled *"The role of N3 Relaxation Dynamics in Regenerative Photovoltaic Cells"*. Along with several others at IRL, he acted as a judge for the Wellington Region NIWA Science Fair.

Tim Kemmitt has recently returned from a three month BRAP-assisted research stint at the University of Lyon, working with **Professor Liliane Hubert-Pfalzgraf**. PhD student, **Gabriel Ossenkamp** has recently submitted his PhD thesis and awaits examiners reports and oral exam; meanwhile his last known whereabouts was somewhere in the frozen wastes of Greenland!

Victoria University

Professor John Spencer had a most profitable, though short period in the Pittsburgh laboratories of Nobel Laureate **Professor Alan MacDiarmid** and was able to accomplish some of the experimental work that had been planned. **Professor Brian Halton** returned from research leave in Europe in mid-July, not as planned but under the repatriation component of his university health insurance – yes people do need cover – following two weeks

hospitalisation in the Netherlands and a week of convalescence. As his editorship of this *Journal* is a hobby and not work, he is able to attend to its needs! With these academics returned, **Dr Peter Northcote** has been able to take his research and refresher leave and is currently spending time in the Scripps Oceanographic Institute in La Jolla, California, with the group of **Professor John Faulkner**. It would seem that Peter has jumped from the frying pan into the fire as John is to undergo heart treatment and he will be spending at least some of the time looking after the research group there!

Dr John Hoberg attended the International Carbohydrate Conference in Cairns and then the ICOS meeting in Christchurch in July with most of his group. Poster presentations of their synthetic work were presented at both locations. **Drs David Weatherburn** and **Rose Gong**, and PhD student **Perry Davy** presented papers at the 16th International Clean Air and Environment Conference that was held in Christchurch in late August.

Recent visitors to the School have included **Dr Slovenko Polanc** (University of Ljubljana, Slovenia) who spoke on "The Chemistry of Nitrogen-Containing Organic Compounds". Slovenko is a former student of **Professor Stanovnik** of the same institution, with whom **Professor Halton** had a collaborative programme during the late 1980s. **Dr Peter H. Seeberger** (Massachusetts Institute of Technology) visited **Dr John Hoberg** and gave a lecture entitled "Automated Solid Phase Synthesis of Oligosaccharides: From Basic Chemistry to Malaria Vaccines".

Gareth Dixon has completed his PhD studies successfully defending his thesis *Aspects of Strain in Organic Chemistry*. He worked with **Professor Halton** and is now studying Patent Law in Manchester.

Chemistry Olympiad 2002 – Groningen, The Netherlands

The 34th International Chemistry Olympiad was held in The Netherlands in July this year. The New Zealand team comprised Peter Lau from Mt Roskill Grammar School, Gemma Mason from Burnside High School, Andrew Yearsley from Avondale College, and Kelvin Peng from Auckland Grammar School. The team was accompanied to Europe by Drs Robert Maclagan (Head Mentor), Shelia Woodgate (Scientific Observor), and Suzanne Boniface (Mentor). The non-travelling reserves were Alan Chan from Westlake Boys' High School and Paul Cheng from Macleans College.

For the students the Olympiad began with a Chemistry test in November last year. They were then invited, on the basis of their test result, to complete a number of assignments and then attend a camp in the April holidays. The Chemistry that was studied at the camp was challenging and mostly new to the students. Each topic was introduced with a lecture, which was followed by a series of practice problems and, sometimes, a practical session. At the end of the camp the students sat a three-hour exam. A group of six were selected to sit another three-hour exam two weeks later and from these the team was selected. Each week of the next term there was further study and more assignments to prepare the successful candidates for the competition. On the first Wednesday of the July holidays the adventure began with the flight from Auckland to Amsterdam via Singapore. One day was hardly enough to explore the wonders of Amsterdam but that was all the time available before a two and a half hour train ride to Groningen, a city in the North Eastern province of the Netherlands. In Groningen, the organisers of the Olympiad welcomed us at the Academiegebouw, and the next day the formal opening was held in the Martinikerk - a 1000 year old church in the centre of the city. There were 57 different countries competing this year and as each country was welcomed their flag was presented and displayed. As well as the competing countries, 20 others sent observers in order to prepare them for taking part in future competitions. Lunch and then the parting of the ways between the mentors and the teams followed the formal ceremony. Cell phones had to be handed in to the organisers. The team stayed close to Groningen for the remainder of the competition while the mentors and the observers were accommodated in a holiday resort It Wiid in the middle of Friesland. On the way they were taken to inspect the laboratories for the practical examination to be held two days later. The mentors of all participating countries debated both the practical and theoretical examination questions at considerable length before they were translated into the native language of the students. The two examinations were both 5 hours long and the theme chosen by the host country was "Chemistry and the Quality of Life Go Hand in Hand". The practical examination was in three parts. The first experiment was a titration used to determine the degree of hydrolysis of racemic methyl *N*-acetylphenylalaninate. In the second experiment benzylhydantoin was synthesised from natural *S*-phenylalanine in two steps. The purity of the product was determined by TLC analysis, which the students were required to carry out, and the melting point of the prepared product determined by the examination committee using automatic melting point apparatus. In the third experiment the iron in an iron pill was determined spectrophotometrically from the orange-red colour of the complex formed between iron(II) and 1,10-phenanthroline. Hydroxylammonium chloride is added to ensure that all the iron(III) is reduced to iron(II) and the absorbance of the solution was used to determine the amount of iron in the pill. A major challenge for the competitors was to complete all the tasks in the given time, which often meant beginning a new task before another one was complete. The written paper was divided into four themes and consisted of ten relatively short questions ranging from biochemistry to physical chemistry. While the paper proved a challenge to our students they all gained full marks for some of the questions. For both mentors and students the hospitality of the host country was superb. The students

enjoyed a range of social activities including their "Mega Olympic Games" and a chance to explore the nightlife in Groningen. Everyone enjoyed an excursion to Amsterdam, which included a visit to the Science Museum, the Rijksmuseum, and a boat tour through the canals of Amsterdam. The mentors and observers explored the local Freisland countryside by bicycle and boat, which provide much of the transport in this region.

The Olympiad closed with the medal presentation. The New Zealand team performed well receiving three bronze medals (Kelvin Peng, Andrew Yearsley, and Peter Lau) and an honourable mention for Gemma Mason who scored full marks on more than one question. For these New Zealand students this was an opportunity of a lifetime - an experience they would love to repeat. Meeting students from so many different countries was amazing - "I don't think I have ever talked to so many people in such a short space of time". This provided a wonderful opportunity for our students to develop academically and in their international understanding while at the same time being great ambassadors for New Zealand.

Above: The 2002 New Zealand Chemistry Olympiad team: (Right to Left) Kelvin Peng, Peter Lau, Gemma Mason, and Andrew Yearsley (right) with mentors Drs Robert Maclagan and Suzanne Boniface.

Financial support has been received by the New Zealand Chemistry Olympiad Trust from the Faculty of Science, University of Auckland, the Department of Chemistry, University of Canterbury, New House Publishers, Crescendo Enterprises, ABA, Unilever, Bayer, Thermoplastic Engineering, School Supplies, Biolab Scientific, Gough Technology, the Woolf-Fisher Trust, and the NZIC Council and the Auckland, Canterbury and Wellington Branches of NZIC.

PORTRAIT OF MAURICE WILKINS COMMISSIONED

Thanks to the generosity and vision of the eight organisations listed below that includes the NZIC, a portrait of the less well known, but New Zealand born Nobel Laureate, Professor Maurice Wilkins has been commissioned. Professor Wilkins (86), who shared the 1962 Nobel Prize for Physiology and Medicine with Francis Crick and James Watson for the discovery of DNA, was born in Pongaroa in the Wairarapa, where his father was a doctor. The family then moved to Kelburn in Wellington where they stayed until Maurice was six years old. Although he never returned to New Zealand, Professor Wilkins still has clear memories of his early childhood in New Zealand. He recalls the long walk to Pencarrow Head on the Wellington coast when he was only four-and-a-half, and his father's praise for his fortitude.

The Royal Society of New Zealand in association with the New Zealand Portrait Gallery has commissioned the portrait. The artist undertaking the commission is Juliet Kac, a New Zealander living in Brighton, England. She expects to have the painting completed by the time this appears in print. Eventually it will hang in RSNZ's Science House, alongside the recently completed portrait of Professor Alan MacDiarmid that was painted by Marianne Muggeridge.

Contributors to the commissioned painting were:

- Auckland University of Technology, College of Sciences
- Massey University
- New Zealand Institute of Chemistry
- New Zealand Institute of Physics
- New Zealand Society for Biochemistry and Molecular Biology
- Royal Society of New Zealand, Wellington Branch
- UNESCO
- Faculty of Science, Victoria University of Wellington

Information on Professor Wilkins' life and achievements can be found at:
http://www.nzedge.com/heroes/wilkins.html

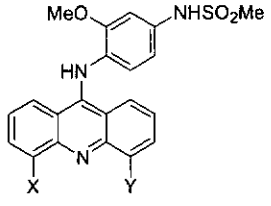
Drug Development In The Auckland Cancer Society Research Centre

Gordon W. Rewcastle and William A. Denny
Auckland Cancer Society Research Centre, Faculty of Medical and Health Sciences,
The University of Auckland, Private Bag 92019, Auckland

The Auckland Cancer Society Research Centre (ACSRC) officially came in to existence in 1998, with the signing of a Memorandum of Understanding between the Auckland Cancer Society and the University of Auckland. This agreement established the ACSRC as an autonomous research centre in the Faculty of Medical and Health Sciences of the University. Prior to that, the Cancer Society administered the Cancer Research Laboratory (CRL), as it was then known, with rental payments being made to the University for the use of the Medical School facilities. The Cancer Society continues to provide core funding to the Centre, although the staff have now become employees of the University.

The original CRL was established by the Cancer Society in 1956, under the leadership of the late Professor Bruce Cain, and actually resided in three different locations before moving to its current location in Building 504 of the Auckland Medical School in 1979. The laboratory has steadily increased in size over the years, and now comprises a multi-disciplinary team occupying two floors of the building, with one floor devoted to biology, and one mainly to chemistry. Total staff numbers are now over 70, with approximately 40% being chemistry research or support staff, and the remainder biologists.

The Auckland Cancer Society set up the original CRL with the aim of carrying out research into the treatment and causes of cancer, and the primary objective of the research programme has always been the development of more effective chemotherapy and radiotherapy treatments for cancer, and the identification of both the causes of and protective factors against cancer. These objectives encompass a number of chemical and biological concepts, and this article will not attempt to cover them all. Rather it will concentrate on the more chemical aspects of this research programme, pertaining to the design and development of new and/or improved anti-tumour agents. The ultimate aim of any cancer chemotherapy programme is the successful development of a clinical agent, and to date six compounds, developed wholly or jointly by the ACSRC, have advanced to the point where they have undergone human clinical trials. Of these, three are currently undergoing evaluation, two have failed to advance, and one, namely the anti-leukaemia agent Amsacrine (**1**),[1] has successfully passed all trials to be accepted as a clinically useful drug for human leukaemia. In 1983 Amsacrine became the first synthetic DNA-intercalator to be licensed as an anticancer agent, and remains today as the only new anti-cancer drug to have been developed for clinical use in the Southern Hemisphere.



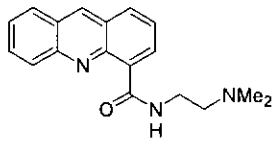
1, X=Y=H; Amsacrine
2, X=Me, Y=CONHMe; Asulacrine

The development of Amsacrine came as a result of a programme in the 1970s looking at 9-anilinoacridines as DNA intercalating agents, although it was not clear until the mid-1980s that the mode of action of these compounds actually involved inhibition of function of the DNA processing enzyme topoisomerase II (topo II). Topo II is a homodimeric enzyme that is responsible for cleaving the two strands of the DNA double helix, so that other strands can pass through, then reconnecting the two loose ends. Without the action of the enzyme to relieve the torsional stress generated, the DNA is not able to replicate. DNA intercalating drugs such as Amsacrine form ternary drug-DNA-topo-II complexes, with the drug distorting the DNA structure and preventing the rejoining of the two loose ends by the enzyme. Thus the DNA is not able to successfully replicate, and the tumour cell is not able to divide and therefore eventually dies.

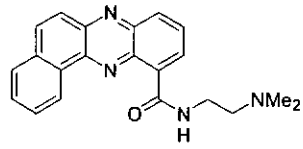
Although Amsacrine was active against leukaemia cells, it was not active against solid tumours due to poor distributive properties, mainly due to the fact that it was fully protonated at physiological p*H*, and therefore unable to migrate efficiently through cell membranes. However, further work led to the 4-carboxamide derivative Asulacrine (**2**)[2] which displayed much better pharmacokinetics, mainly due to a lower pK_a. Very good activity was seen against mouse solid tumours, and on the basis of this Asulacrine was entered into human clinical trials, both in New Zealand and overseas. Although some responses were seen, it unfortunately failed to display the desired level of clinical efficacy, and development was terminated.

The work with the 9-anilinoacridines did not stop with Asulacrine however, since it was found that the 4-carboxamide group offered an excellent position for the addition of amine containing substituents that dramatically increased the DNA affinity of the molecule. In fact, the increase in DNA binding was so significant that it was possible to dispense with the anilino side chain altogether and still retain anti-tumour activity. This work eventually led to the development of DACA (XR-5000) (**3**),[3] which

was the first dual inhibitor of both of the main topoisomerase enzymes (topo I and topo II) to go to clinical trial.



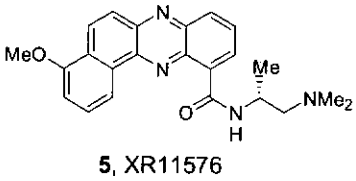
3, DACA (XR5000)



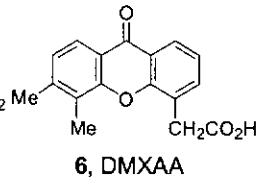
4, SN 23700

Exhaustive Phase II clinical trials of DACA were conducted in Europe, but unfortunately it showed only limited activity as a single agent, and development was terminated in 2001. However, all was not lost, as very early on in the development of DACA it had been discovered that the presence of an additional nitrogen atom in the central ring gave rise to a series of potent phenazine-1-carboxamides, including the 8,9-benzo derivative SN 23700 (**4**).[4]

Joint development of this lead structure by the ACSRC and Xenova Ltd in the UK has now produced the potent second-generation analogue XR-11576 (**5**),[5,6] which began Phase I clinical trial in the Netherlands in February 2002. Like DACA, XR11576 is a dual inhibitor of both the topoisomerase I and II enzymes, but has the added advantage of oral bioavailability. We await the results of the clinical investigation.



5, XR11576

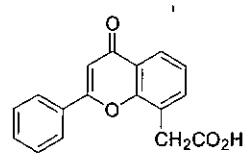


6, DMXAA

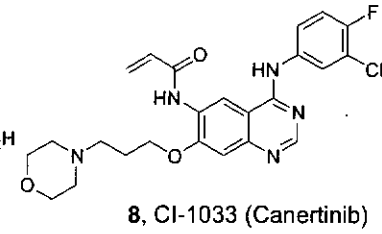
While the ACSRC has remained at the forefront of research into the development of DNA intercalators as anticancer drugs based on inhibition of topoisomerases, increasing knowledge of cell and molecular biology have also given rise to many new potential targets, and these have been pursued also. A major focus of drug development in recent years has been the development of drugs inherently more cancer-selective than topoisomerase inhibitors. One exciting new target is the developing vasculature that is required to support the growth of a tumour. The ACSRC has developed a novel drug, 5,6-dimethylxanthenone-4-acetic acid (DMXAA) (**6**),[7] that causes selective shutdown of blood flow in the tumour vasculature, resulting in necrosis of the tumour.

The discovery of any new anti-cancer drug, or any pharmaceutical for that matter, falls into two distinct phases. The first is the identification of the new lead structure and second, the rational development of that lead into a useful clinical drug. Often it is necessary to refine or "fine-tune" the structure for optimal anti-tumour activity. The development of DMXAA actually began with flavone-8-acetic acid (FAA) (**7**).[8] This drug was first prepared and tested in France as an anti-inflammatory agent, with its anti-cancer activity only being discovered later, during routine screening at the National Cancer Institute in the United States. Following on from this result, a number of groups worldwide investigated analogues of FAA, but we were the first to identify the high activity shown by tricyclic xanthenone analogues in mouse colon tumours,[9] a result that led directly to the development of DMXAA.[7]

DMXAA has undergone exhaustive biological evaluation because of its unique mode of action, which includes a number of immunological effects,[10] and it marks a new approach to treatment, by stimulating the body's immune system to cut off the tumour blood supply. After an earlier investigation by the Cancer Research Campaign (CRC) in the UK, which included clinical trials both in Cambridge, UK, and at Auckland Hospital, DMXAA has been licensed to Antisoma plc, a UK based pharmaceutical company. Antisoma is taking DMXAA to a series of Phase I and II trials in Europe and New Zealand, both as a single agent and in combination with other drugs. The work leading up to the deal was highlighted in a TV3 20/20 documentary in September 2001.



7, FAA



8, CI-1033 (Canertinib)

Another major new area of research involves drugs that selectively inhibit protein kinases, cellular enzymes that phosphorylate other proteins and which are involved in the growth signalling pathways inside cells. The antileukaemia drug Glivec, from Novartis, is a recent successful example of this approach. In a project that began as long ago as 1990, in collaboration with the US Company Warner-Lambert (now Pfizer), the ACSRC sought drugs that would inhibit the growth signalling action of the tyrosine kinase enzyme known as the epidermal growth factor receptor (EGFR). This project culminated in the development of the inhibitor CI-1033 (canertinib) (**8**),[11] which is a water soluble, orally active, irreversible inhibitor of the enzyme, that was first synthesized in Auckland in 1997.

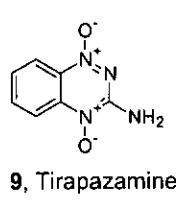
CI-1033 is a 4-anilinoquinazoline derivative, and in this case our collaborators at the Parke-Davis division of the Warner-Lambert Company identified the original lead structure. Extensive investigation of this original lead, both in Auckland,[12] and in the USA,[13] was greatly assisted by computer modelling of the active site of the enzyme. CI-1033 functions by competing with adenosine 5′-triphosphate (ATP) for binding in the normal ATP binding site of the EGFR, thus preventing the kinase from performing its normal phosphorylation role. A number of pharmaceutical companies currently have inhibitors of EGFR in clinical trial, but most of these compounds are reversible inhibitors that still allow the ATP to partially bind. CI-1033 is different in that it functions as an irreversible inhibitor of the enzyme, due to a specific alkylation of cysteine-773, in the binding pocket of the receptor, by the acrylamide portion of the molecule. CI-1033 is now undergoing extensive Phase II clinical trials in the US, and is the first irreversible kinase inhibitor to reach trial.

Our investigation of protein kinase inhibitors has not ceased with the discovery of CI-1033 however, and collaboration continues with Pfizer (who bought out Warner-Lambert), investigating inhibitors of various tyrosine or serine-threonine kinases involved in growth signalling pathways that are implicated in cancer. We are also collaborating with Pfizer in a joint project on the development of new antibacterial agents.

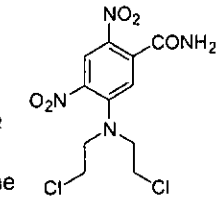
There is also much work in the ACSRC on the development of prodrug forms of classical cytotoxic agents, which are activated selectively in tumours. The dose limiting toxicity of many of the current cancer chemotherapy agents results from their killing of normal dividing cell populations, such as in the bone marrow. If successful, the prodrug approach offers the advantage of better exploiting the current cytotoxic drugs, but specifically activating them in tumour cells, without toxicity to the surrounding normal cells. The critical issue is, of course, the mechanisms that can be exploited to achieve tumour-specific activation of such prodrugs. Three such mechanisms are being studied currently in the ACSRC: activation by endogenous enzymes under hypoxia, activation by therapeutic radiation, and activation by gene therapy approaches.

The hypoxia-activated prodrug approach takes advantage of the fact that severe hypoxia (deficiency of oxygen) occurs only in tumour tissue, since nomal cells generally have a well-oxygenated blood supply. While these hypoxic tumour cells normally limit the effectiveness of both radiotherapy and chemotherapy of solid tumours by their greater resistance, they also represent an attractive therapeutic target, since prodrugs able to be activated to toxic species by endogenous cellular reductases in hypoxic cells are thus potentially tumour-selective. Such activation is possible because normal (oxygenated) cells are protected, either by the ability of oxygen to back-oxidize intermediate metabolites, or by oxygen blockade of the activating enzymes. The most advanced hypoxia-activated prodrug is tirapazamine (**9**),[14] which was originally discovered by Stanford Research in the USA, and which is currently in Phase III clinical trial. A joint programme developing analogues of tirapazamine, involving groups at both the ACSRC and Stanford University, is currently underway with funding from the US National Cancer Institute (NCI).

A second approach towards activating prodrugs employs the reducing radicals produced when ionising radiation is absorbed by water. This project is funded by the New Enterprise Research Fund (NERF) of the New Zealand Ministry of Science & Technology, and has the major theoretical advantage of exploiting the targeting ability of radiation therapy to confine activation to the tumour-bearing volume, thereby overcoming toxicities towards normal tissues. The key challenge being faced by ACSRC chemists is the identification of prodrugs that can be activated efficiently by reduction by a single electron, to provide cytotoxic effectors of very high potency. This is required, to compensate for the low yield of radiation-induced reductants at the radiation doses used typically in conventional radiotherapy.



9, Tirapazamine



10, SN 23862

The third prodrug approach involves compounds that are substrates for exogenous (non-human) enzymes), that can be introduced and expressed selectively in tumour cells by vectors such as genetically engineered viruses or bacteria. These organisms can replicate selectively in tumour tissue, thereby selectively delivering the non-human enzyme, which can be used for the tumour-selective activation of a systemically delivered prodrug. This concept is called gene-directed enzyme-prodrug therapy (GDEPT). A system under study in the ACSRC involves the aerobic *E. coli* nitroreductase enzyme. An example of a prodrug for this nitroreductase is the dinitrobenzamide mustard derivative SN 23862 (**10**) that is activated to a cytotoxic metabolite by reduction of the 4-nitro group to the hydroxylamine by the nitroreductase enzyme.[15]

The research in the ACSRC continues to evolve, and as genomics (defining genes and their regulation) and proteomics (defining protein structure and function) begin to play a major role in drug design, the ACSRC is moving to meet this challenge. It was recently successful as a partner in an application to set up the Centre for Biomolecular Discovery in the University of Auckland.

The ACSRC has always strived to achieve high-class research results in all its fields of endeavour, and it has received a number of recognitions for this. Perhaps the most notable academic achievement was the award of the Royal Society of New Zealand's Rutherford Medal for Science and Technology in 1996. However, none of the success would have been possible without the financial support of a number of different agencies. The Auckland Cancer Society has always (since 1956) provided the core funding for the ACSRC, but additional competitive academic grants have been provided by a number of different agencies, including the Health Research Council of NZ, the Cancer Society of New Zealand, the Auckland Medical Research Foundation, the Marsden Fund of New Zealand, the New Enterprise Research Fund of New Zealand, the Wellcome Trust and the US National Cancer Institute. However, the high costs of drug development and clinical trials have meant that commercial assistance has also been essential, and undoubtedly the most notable contribution in this area has been the twenty-three year collaboration with the Warner-Lambert Company, and their successor Pfizer. Starting with Amsacrine and analogues in 1979, this collaboration has continued to grow over the years, to the point that there are now thirteen Pfizer funded chemists working in the ACSRC, and we look forward to this collaboration continuing to flourish in the future.

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Israeli Scholars: Statement By International Council For Science

Since its inception in 1931, the International Council for Science (ICSU) has affirmed and vigorously upheld the principle of universality of science based on the human right of scientists throughout the world to participate in scientific activity without any discrimination on the grounds of citizenship, religion, creed, political stance, ethnic origin, race, colour, age or gender. It has argued that the processes of academic research and scholarship, and the unfettered pursuit of knowledge, are of benefit to mankind as a whole. Moreover, they are dependent for their advance upon the freedom of scholars to converse, to make contact, to travel to conferences, to publish their results and to proffer advice. It is, therefore, in the interests of governments, institutions and above all individuals – whether themselves scholars or not – to support this principle of non-discrimination. Bona fide scholars pursuing academic activities should be free to do so without hindrance.

Recent moves to foster an academic boycott of Israeli scientists and the dismissal of two Israeli scholars from their roles on the editorial boards of two journals published in the United Kingdom are a flagrant breach of this principle and have rightly drawn substantial adverse comment from scientists, newspaper columnists and human rights activists in the United Kingdom.

On behalf of the Executive Board of ICSU, we draw attention to these events to remind all our national member academies and research councils and our scientific unions and associates of the critical importance of the principle of non-discrimination and of the need for constant vigil in securing its continuing adoption. We understand the strong feelings generated by conflicts, for example that in the Middle East, and the desire of individuals and groups to avoid contact, actively boycott or otherwise demonstrate distaste or disgust for the actions of nation state governments and others. But to do so through the medium of individual scholars is to sacrifice a profoundly important principle of freedom.

We urge all scholarly communities and not least those in science and technology, to heed the words in the *London Evening Standard* on 10 July 2002: "Intellectual communities world-wide are in the business of fostering international understanding and co-operation not of penalising each other for the shortcomings of their governments."

James C.I. Dooge — Chairman
Peter Schindler — Executive Secretary
ICSU Standing Committee on Freedom in the Conduct of Science.

Editor's Note: Council of NZIC supports and affirms these views.

Antibiotic resistance: Structural aspects of enzymatic deactivation of the aminoglycosides

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Introduction

> *"Although the Soldiery retreated from the Field of Death, and encamped out in the City, the Contagion followed, and vanquish'd them; many in their Old Age, and others in their Prime, sunk under its cruelties; of the Female Sex most died; and hardly any children escaped; and it was not uncommon to see an Inheritance passed to three or four Heirs in as many days; the number of Sextons were not sufficient to bury the Dead."*
> - Nathaniel Hodges; Loimologia: An account of the London Plague—a disease eradicated due to research into antimicrobial agents.

The history of the world is littered with pandemics of infectious diseases that were so wide spread, it was more common to die before middle age than not. Other infections that were seemingly less severe, such as ear, skin and throat conditions, often left the patients with disfigurement and sometimes death due to septicemia and other complications. The biological fight against the causative agents responsible for such conditions led to British scientist Alexander Fleming observing the antibiotic effects of a humble fungus that would later become known as penicillin.[1] This was so effective against conditions that were usually fatal that scientists referred to it as "the miracle drug". The discovery led to a revolution within the healthcare industry, and the development of other drugs, such as sulfonamides, tetracyclins, quinolones and aminoglycosides. These antimicrobial agents have reduced mortality and morbidity by such a degree in such a short time that its now more common to reach beyond middle age than not.

Just a few years after penicillin appeared on to the market, scientists and physicians began to notice the emergence of strains of penicillin-resistant *Staphylococcus aureus*, a bacterium usually present in the flora and fauna of the human body. Believing these to be a small number of isolated cases, the clinicians were content to simply observe the patients in question. When it was realised that this was indeed a problem, patients were introduced to newer and stronger drugs, as they became available.[1] Over the past twenty to twenty-five years, the problem of resistance has spread. Patients are now presenting with infectious diseases that are resistant to drugs that were once highly effective. For example, in countries of the former Soviet Union, drug resistant *Mycobacterium tuberculosis*, the bacterium that causes tuberculosis, is rife, with approximately one in ten patients suffering from strains that are resistant to two of the most effective anti-tuberculosis drugs available. In October 1999, *The New Zealand Herald* reported the death of two patients undergoing treatment at Middlemore Hospital.[2] The deaths were partially attributed to an infection by a multi-drug resistant strain of *Acinebacter baumannii*. Reports of patients still carrying the bacteria were being presented[3] well into the year 2000.

Fully 60% of infections picked up while patients are in hospital are now drug resistant.[2] In the United States, approximately fourteen thousand individuals are infected and die each year from drug resistant microbes acquired in hospital. Because hospitals and nursing homes typically house large numbers of immuno-compromised patients, organisms that are usually considered harmless in a healthy individual are able to proliferate without being challenged or held in check by the body's immune system.[1] Of added concern is evidence that suggests that hospital infections rarely stay within a hospital setting. Patients presenting with an apparent community-acquired resistant bacterium have had that strain of bacterium traced back to a hospital outbreak. It is only a matter of time before a bacterial strain emerges that is resistant to all of the known antimicrobial agents.

The report entitled "Overcoming Microbial Resistance" issued by the World Health Organisation[1] says that the world has approximately a decade to ensure that further generations do not face the same childhood diseases that terrorised our grandparents. "Before long, we may have forever missed our opportunity to control and eventually eliminate the most dangerous and infectious diseases". "If we fail to make rapid progress during this decade, it may become very difficult and expensive - if not impossible - to do so later. We need to make effective use of the tools we have available now."

The Development And Spread Of Resistance

Five observations have been published in a joint effort between the Society for Healthcare Epidemiology of America and the Infections Diseases Society of America, that strongly suggests a correlation between antimicrobial exposure and the emergence of resistance.[4] The observations are as follows:

- The prevalence of resistance is paralleled by an increase in the usage of antimicrobial agents.
- Resistant nosicomial bacterial strains are more common than resistant community-acquired bacterial strains.
- During outbreaks of nosicomial infections, patients infected with resistant strains are more likely to have been treated with antimicrobial agents than control patients who are not infected with drug resistant strains.
- Areas within hospitals that have the highest rate of resistance also have the highest rate of antimicrobial use.

- Increasing the time of exposure of a patient to an antimicrobial agent also increases the likelihood of colonization with resistant organisms.

These observations led to the development of two hypotheses concerning the development and spread of resistance. The first was the Reservoir Hypothesis.[5] This hypothesis assumes that the presence of a threshold concentration of an antimicrobial agent first induces and then maintains resistance, since mutations in the genes targeted by drugs are not phenotypically neutral but are uncompetitive in the absence of the drug.[5] The threshold concentration must be high enough that selection is made on even those microbes that are not a clinical threat, such that these organisms begin to prosper and spread. The challenge to this hypothesis is that antibiotic resistance is known to be maintained within an antibiotic-free environment.[6] Resistance mechanisms may not persist because of antibiotic selection, but rather because the gene(s) are beneficial to the host or vector in various ways.[5] An example of this is the bacterial protein recA. This is a DNA repair enzyme that is able to neutralize two antimicrobial agents—UV radiation and mitomycin-C. Because of its DNA-repair abilities, the protein will continue to be selected, and because it persists within the organism, the bacterium will always be protected from UV radiation and mitomycin-C.[5] In this example the presence of a threshold concentration of an antibiotic agent is not needed to induce and maintain the resistance phenotype. Instead, natural selection ensures that the microbe survives.[1] This is the second hypothesis, whereby resistance is maintained by Natural Selection. When a microbial population is exposed to an antibiotic, the susceptible organisms will die, leaving only those that are resistant. These organisms are then free to inhabit the niche of the previous pathogenic organism and to pass on their resistance phenotype either to offspring *via* replication, or to other bacteria *via* horizontally mobile elements, such as plasmids.[1] If this point of view is taken in to account, the relationship between antibiotic agents and resistance is a correlation rather than cause-and-effect as seen in the Reservoir Hypothesis[5] and all of the above observations still hold true. Natural Selection is now accepted as being responsible for the spread of resistance.[1]

Interactions Between Patient, Pathogen, And Drug

One factor that has been implicated in emerging resistance is the intricate relationship between patient pharmacokinetics and bacterial pharmacodynamics.[4] There are four parameters involved in pharmacokinetics, namely absorption, distribution, metabolism, and elimination of the drug, all of which are dependant on the state of the patient at the time the agent is administered.[7] Altogether, these parameters determine the concentration of the drug at the active site, and hence the amount available to exert either a positive or negative effect. Pharmacodynamics is concerned with the interaction of the drug with the physical and chemical active site where it will exert its effect.[7] In this example, it refers to the interaction between the antibiotic agent and the bacterial species it is aiming to decimate. Analysis of the pharmacokinetics and the pharmacodynamics broadly define the relationship between drug concentrations achievable in humans and the *m*inimum *i*nhibitory *c*oncentration (MIC) for antimicrobial effect by the treatment drug.[4] Quantitative pharmacodynamic parameters, such as the ratio of maximum serum antibiotic concentration to the MIC or the duration of time that antibiotic concentration exceeds the MIC, have been proposed as predictors of clinical success or failure between different pairings of drug and bacteria. These pharmacodynamic relationships will continue to be the subject of in-depth studies with four main aims: [7]

- to provide a cost effective and efficient method to help develop new antibiotics;
- to assist in differentiating antibiotics of the same chemical class and in making antibiotic formulary selections;
- to aid in the design of optimal antibiotic strategies for patients with severe infections; and finally
- to help limit or prevent the development of antibiotic resistance.

Airborne Resistance Signals

Bacteria are able to send messages by releasing substances into the environment in which they are growing, a process called Quorum Sensing. One mechanism by which this occurs depends on molecules called Auto-Inducers.[8] These are secreted to enable the synchronization of events across the entire colony. Such events include the development of a biofilm, bioluminescence, or the expression of immune molecules. An example of the latter is to warn other nearby organisms of onslaught, for example, from an antibiotic agent. This in turn will either send information to other microbes within the biofilm or will recruit roaming bacteria to the biofilm in order to fight the antibiotic. Airborne messages have now been implicated as a possible mechanism by which these signals may be sent.[9] Moreover, in the presence of antibiotic drugs, the signals sent seem to induce the resistance phenotype in other bacteria that have not yet come into contact with the antibiotic agent. Experimental results indicate that even though the signal does not carry very far on its own, it may travel further when in a breeze, for example in a hospital where a fan will usually be in operation. This may partially account for the rapid spread of resistant organisms within a hospital setting. Further analyses will need to be carried out before the exact component of the signal can be isolated.[9]

Aminoglycoside Antibiotics

Aminoglycoside Structure

Aminoglycoside drugs are water soluble weak bases that are positively charged at physiological p*H*. All members of this class of antibiotics share a six-membered dibasic aminocyclitol ring,[10] to which amino and hydroxyl groups are attached through glycosidic bonds.[11] Individual members are differentiated by the identities of substituent groups.[12] Streptomycin was the first aminoglycoside to be discovered and is generally considered to be the parent molecule. Its structure comprises three rings with one highly substituted aminocyclitol ring linked to a modified

ribose. The latter is linked to an *N*-acetylglucosamine. With the addition of both natural and synthetic members to this family, two subclasses are now recognised and classification is done on the basis of the aminocyclitol ring. The first subclass contains a streptidine derivative as described above, and is referred to as the streptomycin group. The second, and larger subclass has a large central aminocyclitol ring (termed the B ring) with two or three substituted aminoglycan rings. The latter are linked either at the 4- and 5-hydroxyl groups of the B ring, as in neomycin, or at the 4- and 6-hydroxyl groups, as in kanamycin. They are referred to as the kanamycin/ neomycin group. Figure 1 shows the aminoglycoside drugs streptomycin and kanamycin.

Function and Physiological Properties

Aminoglycoside antibiotics are important therapeutic agents for serious systemic infections.[13] These include the treatment of endocarditis and enterococcal infections, as well as infection from aerobic gram negative bacteria such as *Escherichia coli* and *Pseudomonas aeruginosa*.[13] Aminoglycosides are natural products of fungi from the family *Actinomycetales*.[14] For example, streptomycin, kanamycin, neomycin and tobramycin are products of *Streptomyces spp*. Gentamicin and sisomicin are products of *Micromonospora spp*.[14]

Antibiotics of this family are bactericidal, making them unique among the antibacterial agents that act by inhibiting protein synthesis.[11] They exert their effects by binding tightly to the functional center[15] of the aminoacyl tRNA site within the 30S subunit of the bacterial ribosome.[10] This binding is much stronger than that of other protein synthesis inhibitors, possibly accounting for why these are the only protein synthesis inhibitor drugs that cause bacterial cell death.[11] In the absence of these antibiotic agents, translation requires the binding of a ternary complex of Elongation Factor Tu, aminoacyl tRNA and GTP to the aminoacyl site within the ribosome.[15] High level translational accuracy is thought to be a combination of codon/anticodon interaction and a proofreading step occurring after GTP hydrolysis. The exact mechanism by which proofreading occurs remains unclear. This proofreading process is thought to be particularly important for discriminating between codon/anticodon perfect matches and near matches. In the presence of aminoglycoside drugs, the proofreading process controlling translational accuracy is impaired.[10] This allows an incorrectly charged tRNA to bind to the acceptor site on the ribosome, resulting in a polypeptide chain that has an incorrect primary amino acid sequence.[11] The defective protein may then be inserted into the membrane, leading to a loss of cell wall integrity, and cell death.[10] The binding of the drug to the ribosome differs from one aminoglycoside to another.[16] For example, paromomycin binds within the major groove of helix 44 of the 16S rRNA, whereas spectinomycin binds in the major groove of helix 34 of the 16S rRNA.[15] This may explain the differences in killing rates exhibited by different drugs.

Susceptibility to aminoglycoside agents relies on the interaction of the drug with the bacterial ribosome within the cell.[11] Due to their polycationic, and therefore highly polar nature, their concentration within the bacterial cell is dependant upon the transport systems that cross both the inner and outer cell membranes. Passage across the outer membrane of gram negative bacteria is a self-promoted uptake process involving the disruption of magnesium bridges between adjacent lipopolysaccharide molecules.[10] Traversing the membrane *via* porin channels is unlikely due to their large size; they are approximately 18 x 10 x 10 Å. Movement across the inner membrane is *via* an energy-dependent electron transport chain that establishes a proton gradient across the interior and exterior of the cytoplasmic membrane.[16] This is an oxygen dependent system ordinarily transporting polyamines, and is absent in anaerobic organisms, which implies that aminoglycoside agents are only clinically useful against organisms are growing under aerobic conditions.[11] Movement across the inner membrane is rate limiting, and is inhibited by divalent cations and hyperosmolarity, as well as a lack of oxygen.[10]

The p*H* of the site of infection can have a profound effect on the bactericidal ability of the aminoglycoside.[16,17] At p*H* 5.5, bactericidal killing is minimal. At p*H* 6.5, activity is apparent but is not as efficient as that seen at p*H* 7.4.[16] The exact reasons for this effect remain unclear. The clinical implication is that when the pH of the infectious focus is below p*H* 7.4, the *in vivo* aminoglycoside concentration capable of inducing a bactericidal effect may be far above the MIC.

Aminoglycoside Resistance

In 1999, the European SENTRY Antimicrobial Surveillance Program carried out a study in order to analyse the prevalence of aminoglycoside resistance in Europe. It was found that intra-country fluctuations in resistance phenotypes occurred where the policies in antibiotic control

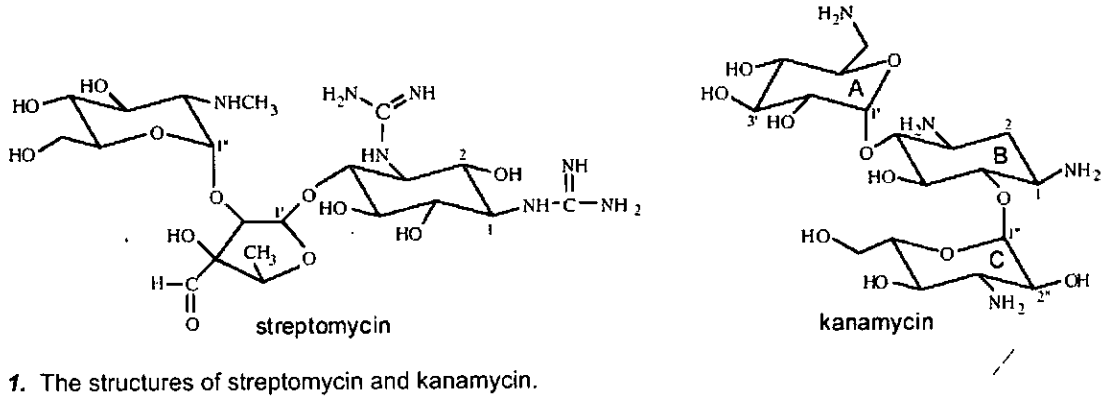

Figure 1. The structures of streptomycin and kanamycin.

and hospital hygiene varied.[13] Overall, the same is true for inter-country variations where wider fluctuations were noted. The results of this study were compared with a similar study (referred to as the ESGAR study) carried out ten years prior to the current one. Although the two are not directly comparable, due to different hospitals and different criteria in choice of isolate, the data indicted that overall, there has been a 10% increase in prevalence of resistance to the gentamicin among *S. aureus* strains over the last decade.

Aminoglycoside resistance may be observed at several levels. Low-level resistance usually results from either a change in permeability or a change in the ribosome binding site.[18] This leads to decreased drug uptake and accumulation.[10] A change in cellular permeability is quite common in *P. aeruginosa*[13] and other non-fermenting gram-negative bacilli.[10] Aerobic gram-negative bacilli also show a phenomenon of adaptive resistance.[10] This is shown as a transiently reduced antimicrobial killing in originally susceptible bacteria, and is most likely caused by membrane protein changes and alterations in the regulation of genes in the anaerobic respiratory pathway in bacteria exposed to aminoglycoside agents. Adaptive resistance is a phenomenon seen in *P. aeruginosa* and other gram-negative bacilli. This reversible form of resistance develops within two to three hours of the initial exposure to an aminoglycoside drug. It then disappears during growth for several hours in a drug-free environment.

The exact mechanism for adaptive resistance is not entirely understood. It may be related to the original down-regulation of aminoglycoside uptake during the initial phase of the drug function. It has been shown that higher aminoglycoside concentrations result in higher levels of bactericidal activity, but also produce a marked increase in the level of adaptive resistance. The duration of adaptive resistance varies from drug to drug. For example, adaptive resistance has been demonstrated to last for four hours in amikacin and five hours in netilmicin. This effect is also exacerbated by the p*H*, where the intensity of resistance is greater at p*H* 6.5 than at p*H* 7.4. However this is difficult to relate to an increase in the adaptive resistance phenomenon, because the bactericidal activity of the drug was shown to be higher at p*H* 7.4 than at p*H* 6.5.[16] High level resistance, in contrast, arises from the chemical modification of the aminoglycoside agent itself, and this high level resistance is now the predominant form of clinical resistance.[10]

Aminoglycoside Modifying Enzymes

This family of bacterial enzymes catalyzes the covalent modification of specific amino or hydroxyl groups present within the aminoglycoside agent.[10] This results in a chemically modified drug that binds poorly to ribosomes, thereby resulting most often in high level resistance. Aminoglycoside-modifying enzymes are often encoded by horizontally mobile elements,[5] including plasmids and transposons. Plasmid exchange and dissemination of transposons facilitate the rapid acquisition of a drug resistance phenotype, not only within a given species, but also within a large variety of bacterial species.[10]

Studies examining the susceptibility of clinical isolates to a range of clinically used aminoglycosides quickly led to the realisation that there existed a large diversity of resistant phenotypes with almost every susceptible position in each drug being modified by several distinct enzymes.[10] A large number of genes have now been characterized with each phenotype being associated with the expression of several distinct enzymes, collectively referred to as the aminoglycoside-modifying enzymes. The enzymes involved are *N*-acetyltransferases (AAC), *O*-nucleotidyltransferases (ANT) and *O*-phosphotransferases (APH). The *N*-acetyltransferases use acetylcoenzyme A as a donor and target amino groups on the drug, and the latter two enzymes both use ATP as either an AMP or phosphate donor, and target the hydroxyl groups on the drug.

The phosphotransferases are the most prevalent class of aminoglycoside-modifying enzymes. There are seven subclasses of enzymes, each with a characteristic substrate profile.[18] The largest subclass are the phosphotransferase enzymes that target the 3′-hydroxyl position of 4,5- or 4,6-disubstituted aminoglycosides, such as kanamycin. In current isolates, this enzyme may make up to 2% of the total bacterial protein.[10] Pairwise comparisons of the sequences of the 3′-aminophosphotransferase enzymes confirm that they have diverged from a common ancestor.[19] The nomenclature used for all of these aminoglycoside modifying enzymes has been proposed by Shaw and colleagues.[20] It has been adopted in order to explicitly include the regiospecificity of the group transfer. The type of enzyme involved is stated first, followed by the target carbon of the drug followed by a roman numeral designating the phenotype and a letter to differentiate the particular genes.

APH(3′)-IIIa

The best studied member of the class of APH(3′) enzymes is APH(3′)-IIIa. This has the broadest substrate specificity of all of the APH(3′) isozymes, displaying the ability to phosphorylate at least nine different aminoglycosides.[18] It may also carry out some additional phosphorylation of 4,5-disubstituted antibiotics at the 5′′-position. It is commonly found in bacteria such as *Staphylococci* and *Enterococci*. The enzyme catalyses the phosphorylation reaction by first binding ATP and magnesium ions, followed by the aminoglycoside agent.[18] The accepting hydroxyl group is then activated by the removal of the proton, followed by attack by the γ-phosphate from ATP. The enzyme releases the phosphorylated drug, followed by the ADP. The slow release of ADP is the rate-limiting step in the overall reaction.

The structure of APH(3′)-IIIa in complex with ADP has been solved to 2.2 Å resolution.[18] A ribbon representation of the molecule is given on the left of Figure 2. The enzyme has two domains, with a small *N*-terminal domain and a larger *C*-terminal domain with the two joined by a 12-residue linker.[12] The protein fold of this enzyme reveals a striking similarity to eukaryotic protein kinases despite less than 6% primary sequence identity.[21]

The 94-residue *N*-terminal domain consists of a five-stranded antiparallel β-sheet,[18] with a helix located between strands three and four.[12] The fold of this region is identical to that of eukaryotic protein kinases except for the existence of a loop between strands one and two. In eukaryotic protein kinases this is the location of the highly conserved G-X-G-X-X-G motif that is involved in nucleotide positioning within the catalytic core of the kinase.[18] This is a flexible glycine-rich motif that forms a shield over the phosphate groups of the bound nucleotide. There is also evidence that this loop plays a stabilizing role during phosphoryl transfer. This motif is missing in APH(3′)-IIIa, but the loop is still present (residues 22-29), and is referred to as the P-loop.

There is a 12-residue linker between the two domains consisting of a short α-helix flanked by regions of random coil.[12] This region also shares structural features with the homologous regions of eukaryotic protein kinases. However, its position within the molecule is shifted relative to its typical position in the kinases. The 157-residue *C*-terminal domain is largely helical in structure[18] and can be subdivided into two regions. Firstly, there is a central core region of two helices and a long hairpin shaped loop with two short stretches of antiparallel β-sheet.[12] Secondly, there is an insert region composed of a helix-turn-helix structure, and the *C*-terminal α-helix together which form a helical sub-domain, as indicated in Figure 2. There are two major differences between the structure of this domain in APH(3′)-IIIa and that of eukaryotic protein kinases, namely a 60-residue insert that is present in APH(3′)-IIIa between helix 4 and strand 6, and the absence of a highly conserved segment responsible for substrate specificity in eukaryotic protein kinases. Both of these differences occur in front of the active site.[18] The 60 residue insert has been proposed to perform an analogous substrate identification function for the aminoglycoside phosphotransferases.[12] The lack of the region involved in substrate specificity and selectivity in eukaryotic protein kinases may explain the wide substrate specificity of APH(3′)-IIIa.

The active site is located in a cleft between the two domains,[18] and is composed of two distinct sub-pockets. A large relatively hydrophobic cavity comprises residues from both domains and is the binding site for the adenine moiety of the ATP. Further towards the front of the cleft, the binding pocket is lined with five conserved residues: Lys44, Glu60, Asp190, Asn195 and Asp208.[12] Conserved in all APH enzymes, these residues are also conserved in eukaryotic protein kinases. They are involved in hydrogen bonding interactions with the triphosphate atoms of the ATP and the active site magnesium ions, anchoring the latter so that efficient phosphorylation of the aminoglycoside can occur. The two active site magnesium ions facilitate the binding of the nucleotide to the enzyme and also help to stabilize the transition state intermediate formed during phosphoryl transfer. The P-loop between β-strands one and two of the *N*-terminal domain forms part of the nucleotide-binding site. It is thought to close over the α- and β-phosphate groups to protect the active site from the external solvent and also to help stabilize the transition state. The aminoglycoside binding site is formed between the central core of the *C*-domain and the helical sub-domain, and although there is no structure of the binary APH(3′)-IIIa/aminoglycoside complex, we have determined the structure of a related enzyme APH(3′)-IIa as a kanamycin complex and this structure confirms the location of the aminoglycoside-binding site (see below).

There are three highly retained sequence motifs present within these enzymes (residue numbering refers to APH(3′)-IIIa):[19]

- VxxHGDxxxxN (residues 202-212)
- GxxDxGR/KxG (residues 224-230)
- DxxK/RxxY/FxxxLDE (residues 273-285)

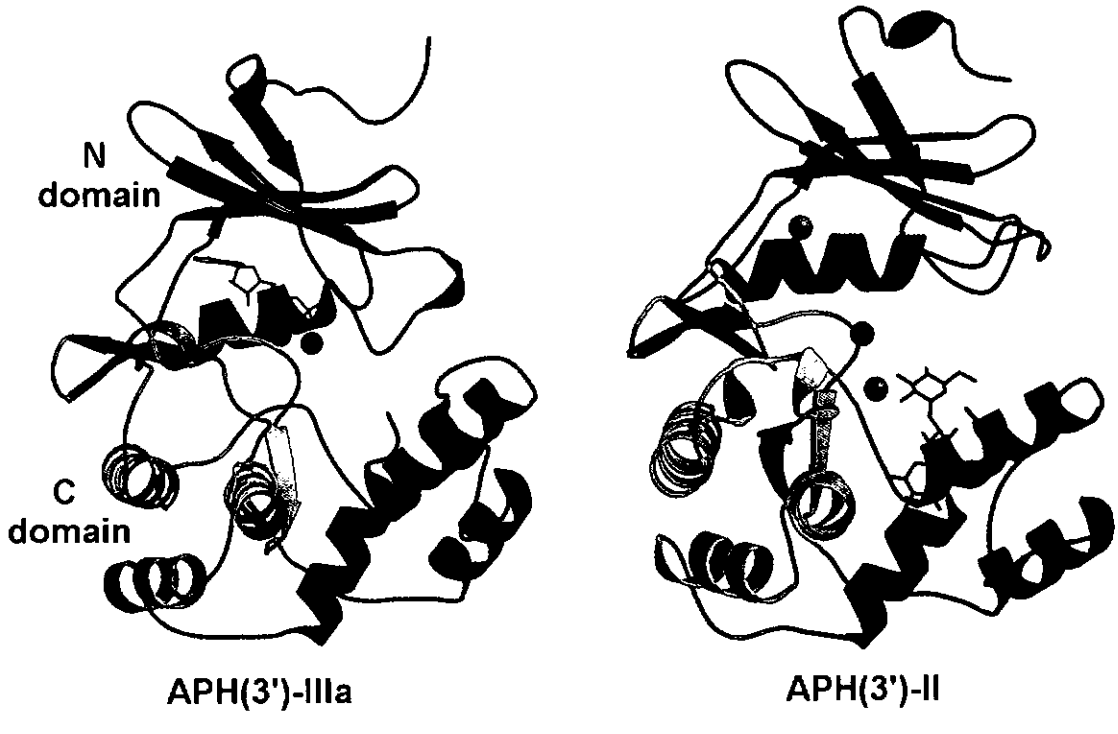

Figure 2. The structures of APTH(3′)-IIIa (left) and APH(3′)-II (right) in ribbon form.

All three motifs are located within the *C*-terminal region of the enzymes. Sequence alignments have revealed that the first and second motifs are both found in nucleotide-binding phosphotransferases associated with a variety of biological processes, including the Ser/Thr and Tyr protein kinases, viral oncogenic protein kinase, Na^+/K^+ transporting ATPase, and antibiotic modifying enzymes.[19] The second motif corresponds to the magnesium-ATP binding site, with the aspartate residue (shown in bold in Figure 2) involved in coordinating one of the Mg^{2+} ions. The first and third motifs are thought to be involved in phosphoryl transfer, and in the splitting of the phosphodiester bond, respectively. Furthermore, the aspartate (HG**D**) in motif 1 is the catalytic base responsible for abstracting the proton from the hydroxyl group that gains the phosphate at the end of the reaction. The aspargine residue is involved in Mg^{2+} coordination as well. The high degree of similarity between eukaryotic protein kinases and APH(3′)-IIIa suggests that the two share a common mechanism of phosphoryl transfer.[12]

Overall, there is a rigidity present in the molecule that can be noted when comparing the structure of APH(3′)-IIIa in its apo form, to the complex with either ADP or a non-hydrolysable form of ATP, AMPPCP.[18] The major positional differences are mainly confined to surface loop regions, where flexibility is not unexpected. There are some minor structural differences that can be seen in and around the active site. In general, these changes occur to either accommodate ATP and the aminoglycoside or because of the extra room afforded by the lack of ATP or aminoglycoside. In the apoenzyme, the polypeptide shifts downward into the nucleotide binding pocket relative to its position when in complex with ATP or ADP (in the overlaid structures, the average deviation between the α-carbons of residues 20-33 was 1.7 Å). In this conformation the polypeptide occupies some of the cavity resulting from the lack of bound nucleotide. This is very different to eukaryotic protein kinases, where whole domain shifts as a consequence of nucleotide and/or substrate binding are more common than not. It was found that a disulfide bond formed between Cys156 of one molecule and Cys19 of the next molecule,[18] such that the molecule was purified and had its structure solved as a dimer. Under physiological conditions this bond is absent.

Site directed mutagenesis studies indicate that the terminal carboxyl residues of the enzyme are critical for efficient substrate binding.[22] Within the *C*-terminal helix of APH(3′)-IIIa is the sequence Leu-Asp-Leu-Phe-COOH. This is conserved across all of the 3'-phosphotranserases. Mutation of the aspartate resulted in an enzyme with impaired ability to phosphorylate the aminoglycoside.

Due to their striking similarities to eukaryotic protein kinases, protein kinase inhibitors were tested for an ability to inhibit aminoglycoside-modifying enzymes. Three representative families of inhibitors were tested: an indolecarbazole-containing alkaloid called staurosporine, two flavanoids, genistein and quercetin, and a range of isoquinaline sulfonamide inhibitors, such as CKI-7, H7 and HA-1004.[23] Staurosporine inhibits protein kinases by binding the ATP site. Unfortunately, it did not inhibit APH(3′)-IIIa in the same manner, despite the general structural similarities of the two within the ATP site. The flavanoids act by competing with ATP for the binding site. Genistein was shown to not cause any significant effect on APH(3′)-IIIa, but quercetin displayed modest inhibition of the enzyme. The isoquinaline sulfonamides competitively inhibit the binding of nucleotide and non-competitively inhibit binding of the substrate.[23] They displayed effective inhibition of APH(3′)-IIa.

APH(3′)-IIa

Enzymes of this class are frequently used as a tool in molecular biology, such as kanamycin selection in prokaryotes and gentamicin selection in eukaryotes.[20] The genes used in such processes are derived from transposon-5 (tn5). It is estimated to have a molecular weight of approximately 30 kDa, with a p*H* optimum of 7.0 - 7.5. It is postulated that APH(3′)-IIa contains the same P-loop as seen in APH(3′)-IIIa.[24] As described above, this loop is thought to capture the phosphate moiety to help position the γ-phosphate so that it is poised for transfer. As such, residues within this region are thought to play a key role in nucleotide binding. For this reason, site-directed mutagenesis has been used to assign functions to specific residues within the P-loop.[20] Mutations of residues within the *N*-terminal domain were tolerated without significant effect on the enzyme.[25] Mutations of residues within the *C*-terminal domain displayed varying effects on the enzyme—some resulted in only a slight change whereas others resulted in a significant change in enzyme activity.[17] For example, removal of the last 24 *C*-terminal residues resulted in an enzyme that had lost its modifying ability,[24] similar to that which has been shown in mutagenesis studies using the enzyme APH(3′)-IIIa.[22] Conversely, the mutation of aspartic acid to glycine at position 227 resulted in an enzyme with characteristics similar to that of the wild type.[25] Mutation of the tyrosine residue at position 218 to serine, aspartic acid or phenylalanine resulted in a change in aminoglycoside recognition but did not affect ATP recognition.[20] Mutation of arginine at position 211 to histidine, lysine, proline, glutamine or glycine was shown to alter ATP binding to significantly reduce enzymatic activity when compared to the wild type.[25] Residue 211 terminates the P-loop. Further studies indicated that the terminating residue for this loop needed to contain a positively charged side chain, indicating why the activity of the enzyme increased when the residue was arginine and decreased when the residue was glycine or glutamine.[25] A mutation of aspartic acid to glycine at positions 190, 208, 216 and 220 either abolished or significantly reduced the level of resistance seen in the resulting strain.[24] The residue at position 188, which is invariant in all known APH enzymes, was determined to be very important—a mutation of this residue resulted in an increase in the aminoglycoside minimal inhibitory concentration and a decrease in the enzyme activity.[20]

We have solved the structure of APH(3′)-IIa to 2.2 Å resolution and the molecule is almost identical to that of APH(3′)-IIIa (see the figure above). There is a kanamycin molecule bound in the aminoglycoside-binding cleft between the central core of the *C*-domain and the helical sub-domain. The inside surface of this aminoglycoside

sub-pocket is lined with negatively-charged side chains (aspartate and glutamate residues), which compliment the positive charges on the aminoglycoside and serve to firstly draw the molecule into the binding site and secondly to orient the molecule appropriately for activation and phosphoryl transfer.[26] The three rings of the kanamycin molecule are associated with three specificity pockets in the binding site which serve to anchor the drug and orient it in such a way that the appropriate hydroxyl group (the O3′ group) is directed towards the side chain of the catalytic base, Asp190. The molecule is poised for reaction but lacks the ATP in the nucleotide-binding pocket. It is thought that specificity for the different aminoglycoside might be due to the presence of a long unstructured acidic loop joining two helices in the helical sub-domain. The structures of these enzymes in the presence of different aminoglycosides will help clarify this.

Resistance to the aminoglycosides through enzymatic inactivation, although seemingly straightforward, is in reality a very complex problem. An understanding of how one such enzyme functions might allow pharmaceutical chemists to render it ineffective. However, this may only be a minor setback to a bacterial cell that could have access to over a dozen of these enzymes. An extensive knowledge of several members of this large family of enzymes will be required to effectively combat the problem. With this structural information in hand, it might be possible to design a series of multi-enzyme inhibitors which would deactivate a range of enzymes and would prove a more effective treatment for resistant strains of bacteria. Although this idea is attractive, it poses huge challenges in that the three classes of aminoglycoside-modifying enzymes bind their substrates in completely different ways. It might be possible to design a compound that would inhibit the majority of the phosphotransferases for example, but it is conceivable that this compound might be completely ineffective against the acetyltransferases.

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The Early History of Scientific Journals

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Everyone involved in the scientific endeavour is faced with the challenge of sifting out the needles in a huge (and exponentially growing) haystack of knowledge. This explosive growth in information poses ongoing challenges to the scientific community and there is an active debate about the future direction that scientific publications should take.[1] In addressing what changes may be appropriate, it is interesting to note the remarkable constancy in the basic features of scientific journals that lie at the heart of science communication. Scientific journals are the principal forum for reporting, criticizing, disseminating and archiving scientific data whilst asserting the priority of authors to their scientific ideas. Remarkably all these features of scientific journals came into being within the first decade of their existence. Not only that, but they have barely changed in the more than three centuries since and, despite highly publicised concerns, *e.g.* about cost and volume of information, do not look likely to change dramatically in the near future. Taylor discusses many of the contemporary issues associated with the field of scientific publications in the following paper.[2] The present contribution is intended to put this debate in context by examining the origins of scientific journals. In order to see how they came into being, and how they came to have the structure that they have, we have to go back to the decade of their birth, namely the 1660s. The organization that can rightly claim to be their parent is the Royal Society of London.

The establishment of the first dedicated scientific journal

The Royal Society of London emerged from the interactions of a group of philosophers and academics, mainly in Oxford, in the middle of the 17th century. It was established as a Royal Society in 1660. As Robert Hooke explained[3] in 1663, the aims of the Royal Society were:

> *"To examine all systems, theories, principles, hypotheses, elements, histories and experiments of all things naturall, mathematicall and mechanicall, invented, recorded, or practised by any considerable authors ancient or modern. In order to the compiling of a complete system of solid philosophy for explicating all phenomena produced by nature or art, and recording a rationall account of the causes of things.*
>
> *In the meantime this Society will not ... dogmatically define nor fix axioms of scientificall things but will question and canvass all opinions. adopting nor adhering to none, till by mature debate and clear arguments, chiefly such as are deduced from legitimate experiments, the truth of such experiments be demonstrated invincibly"*

To this end the Society had regular meetings in which:

> *"the time of the assembly is to be employed in proposing and making experiments, discoursing of the truth, manner, grounds, and use thereof, reading and discoursing upon letters, reports and other papers concerning philosophicall and mechanical matters, viewing and discoursing of curiosities of nature and art ..."*

In short, the Society was to propagate science by experiment and critical debate. Given these aims[3] it is clear that communication lay at the heart of the scientific endeavour, then as now. It was necessary to stimulate critical debate through the communication of scientific reports and, in so doing, establish an archive of scientific information. Science is ultimately a body of public knowledge where the findings of individuals are published and then corrected and clarified by mutual criticism. The resulting, refined, body of knowledge can then stimulate further scientific investigations. It is no coincidence that the rise of science as we know it, the science of Boyle, Hooke, Newton, Huygens (to name just some of the scientists mentioned in this article) takes off in the latter half of the 17th century as scientific communication and information exchange came of age.[4]

Before the middle of the 17th century written communication of scientific ideas had been through a combination of personal letters and books. With the establishment of the Royal Society, there arose the need for an additional form of written record.[3]

> *"[N]ow they had constituted themselves a Society which had received the King's approval it became necessary that its business should be regularly recorded. The Journal-book which had been opened on 5 December 1660 has preserved the story of the launching of the Society on its career and the transactions of its earlier years."*

Hence the Journal-book augmented the dissemination of scientific ideas communicated in books and letters. The responsibility for recording the activities of the Royal Society, and for corresponding with Fellows, scientists and other interested people, fell on the secretary. Robert Boyle was responsible for Henry Oldenburg, a non-scientist, becoming the Secretary of the Royal Society. Fortunately for the future development of science, Oldenburg was an indefatigable communicator and, at times almost single-handed, kept up the flow of scientific information amongst the Royal Society and the wider community of scientists. His correspondence has been published as a multi-volume treatise[5] and provides a fascinating insight into the early history of modern science. It was in Oldenburg's hands that the metamorphosis of personal scientific correspondence into scientific journal articles took place.

In January of 1664 a new journal, the *Journal des Sçavans*, was published in Paris. It proposed to communicate accounts of scientific experiments, but also to include a wider range of intellectual issues. In February,[3] Sir Robert Moray, a leading Fellow of the Royal Society, wrote to Huygens to tell him of Oldenburg's plan for a scientific journal which would avoid the contentious matters of the

kind that had led to the temporary suppression of the *Journal des Sçavans* in March 1664:

> *"As for the Gazette des Sçavans we have seen a sample of it, but already we have found things to criticise in it. You say very well that the thing can be useful provided it not be spoilt. Mr Oldenburg has shown us a sample of similar plan, much more philosophical, and we hope to get him to begin it, if it can be done. He will not interfere with legal or theological matters, but in addition to philosophical matters which come from abroad, he will publish the experiments, at least the most important, performed here."*

It may be here that we can find the origins of the rather austere style of the scientific journal. In any event, the Council of the Royal Society resolved[3] on the 1st March 1664:

> *"That the Philosophical Transactions to be composed by Mr Oldenburg, be printed on the first Monday of every month, if he have sufficient matter for it, and the tract be licensed under the Charter of the Council of the Society, being first reviewed by some members of the same ..."*

Accordingly, the first issue of the *Philosophical Transactions of the Royal Society* appeared on Monday 6th March and the era of dedicated science journals began. The *Philosophical Transactions* combined edited parts of scientific correspondence together with a record of the meetings to inform Fellows who could not be present. The reports were concise with references to the work of others, thus emphasizing the collaborative and cumulative nature of science. The fact that the reports in the journal were shorter than books stimulated scientific developments, since they enabled the quicker turn around of ideas and avoided the vagaries of book publishing.[6] This combination of annotated correspondence and reports of discoveries, reviewed by scientists, essentially corresponds to the invention of primary papers in learned journals.

The emergence of the full features of scientific journals

In contrast to the contemporary challenges facing scientific journals, the main problem that Oldenburg faced in making the *Philosophical Transactions* successful was in drumming up trade—both in encouraging scientists to contribute their ideas and in selling sufficient copies of the journal to make it financially viable. The problem of finding a large enough market for the journal was complicated when the plague broke out in London during the first year of publication—many of the Fellows of the Royal Society left London for the countryside and the weekly meetings were cancelled. In December Oldenburg wrote to Boyle saying that only three hundred copies had been sold and this would scarcely pay for the paper. The situation soon improved and the *Philosophical Transactions* were sold to scientists on the continent as well as in England.

Asserting the priority of scientists to their discoveries

Gradually scientists started to send accounts of their own work and discoveries with a request that the Royal Society would publish them. However, some scientists, such as Robert Boyle, were initially reluctant to publish their scientific discoveries in the Royal Society's journal because of a fear of *"philosophical robbery"*, Boyles's descriptive term for plagiarism. Scientists of the age went to some lengths to safeguard their ideas. Indeed, some recorded their results in cipher or anagrams, or deposited copies of their work in places where they could not be consulted without their prior knowledge and permission. For example, Boyle deposited sealed packets of information with the Royal Society in 1668, 1680, 1683 and 1684 which were opened after his death in 1692 and handed to his legal representatives. There was some substance to their concerns. Robert Hooke, like Boyle, complained extensively of having his ideas appropriated by others. Many of his complaints were groundless, but there was an illustrative exception in early 1674 when Oldenburg brought a letter from Huygens before the Society that described a new type of pocket watch. Hooke claimed to have invented this years earlier and demonstrated it to the Society. He appealed to have the minutes of the earlier meeting examined to substantiate his statement but nothing was found in the Minute book. Hooke then accused Oldenburg of not entering the minutes correctly and of being a 'trafficker in intelligence'. He was ordered by the Council to offer an apology that was printed in the *Philosophical Transactions*. There is now evidence that Hooke *did* present a new watch to a meeting of the Royal Society on 20th February 1668, but nothing appears in the minutes. Furthermore, Huygens had given the patent rights for his watch to Oldenburg and so Oldenburg stood to gain from a deception. It seems that, in this case, Hooke was correct and commercial and scientific espionage were alive and well even in the august surroundings of the Royal Society!

Secrecy is antithetical to science and so a mechanism for establishing priority in published reports became essential in order to develop the critical exchange of information which forms the basis of science. Despite Oldenburg's lapse with Hooke, his careful dating of correspondence did form the basis of the way in which priority of scientific discovery is now handled in the literature. An exchange between Boyle and Oldenburg shows the cut and thrust of this correspondence in action. In an experiment that would stir interesting debate in contemporary animal ethics committees, Carlo Fracassati had reported that injecting dogs with nitric or sulfuric acid killed them by *"coagulation of the blood"*. Oldenburg translated and published this work in English in the *Phiosophical Transactions*, on 23rd September 1667 (No. 27). The science is interesting, not just for the crude way of despatching unfortunate canines. On page 493 Fracassati asserts that the florid colour of blood was caused by exposure to air – perhaps the first such explanation. In any event, Boyle took exception to the report[5] and wrote to Oldenburg on 17th October 1667 to tell him he has performed similar experiments previously on isolated blood:

> *"[A]bout this time three years I mentioned ... to the Royal Society an odd Experiment, I had formerly made (not by Chance but Designe) upon blood yet warm, as it came from the Animal,* viz. *Tthat of putting into it a little Aqua fortis, or Oyl of Vitriol, or Spirit of Salt (these being the most usual Acid Menstruums), the blood not only would presently loose its pure colour and become a Dirty*

one, but in a trice be also coagulated; whereas if some fine Urinous spirit abounding in Volatil Salt, such as the Spirit of Sal Armoniack, were mingled with the warm Blood it would not curdle it, or imbase its Colour, but make it look rather more florid than before, and both keep it fluid, and preserve it from Putrifaction for some time"

Hence, Boyle hints that his ideas have been stolen by Fracassati, and suggests a way of checking the matter:

"This having been so publickly done, though I shall not say, that Signor Fracassati may not have hit, as well as I, upon the Experiments published in his Name, yet there is so little difference between the warm Blood of an Animal out of his Veins and in them, that 'tis not very improbable that he may have had some imperfect Rumor of our Experiment without knowing whence it came, and so may, without any disingenuity, have thence taken a hint to make and publish, what you have English'd for him. Perhaps you will find some entry made of my narrative in the journal of the Society; ...

Oldenburg noted in the margin of Boyle's letter that:

"The Journals of the Royal Society being looked into by the Publisher (who by the honour of his Relation to that Illustrious Body, hath the advantage of perusing them...) do fully agree with the Affirmation of this Noble Person, as well in the Circumstance of the Time, as the Substance of the Matter in question; It being in the Month of December of An. 1664 ..."

In a subsequent letter on 26th October 1667 Boyle continues on the topic. In doing so he both illustrates the critical role of the journals in stimulating scientific debate and indicates the means by which priority disputes can be resolved:

"I am not sorry you found the relation ... you search[ed] for in the journal of the Society: but I am still of the opinion that Signior Fracassati be tenderly dealt with. ... The observation you mention in your Transactions about the florid colour of blood is pretty, and, in the trials I have made of it, it holds true: the reason also given by the author may, perhaps, be good. ...

Care will be taken for the future, that the letters I send you be dated. But in case at any time it should be forgotten, you may be pleased in great part to supply the omission, by endorsing on the letter when you received it; for by that it will appear, that at least it was written as early as the time mentioned in the endorsement."

Having done so, Boyle then explains the problems of British ingenuity being appropriated by foreigners in true "whinging Pom" fashion:

"And I am the more solicitous about this matter, because frequent experience shows us how much our English have lost, for want of being so; and (which is more considerable) how difficult it is otherwise to avoid the occasions of personal disputes or reflections, which for my part, I heartily desire to shun."

In this way, then, the use of dated reports in scientific journals emerges as the means of establishing the priority of scientific discovery. With this security, scientists can, and did, become more open in publishing their results through the journals.

Feedback of fellow scientists

As Boyle, and others, became involved in the formal correspondence they could see more benefits in the system. There was the opportunity to receive the stamp of approval of fellow scientists, both through the simple fact of publication (in a form subject to the scrutiny of peers) and through citations to one's published work. For example, in 1664 Huygens reported to the Royal Society for the first time the interference colours seen when plates of glass are compressed. In reporting his work he referred to a book by Boyle in which the latter had commented on the colours seen in a thin film of a soap bubble. On the 29th October 1664 Boyle wrote a letter to the Royal Society in response, which shows the interplay between rival scientists:[5]

"I was not a little proud to receive ... from so competent a judge so favourable a Character of my Trifles about Colors. And as for what he mentions of ye Iris production betwixt 2 pieces of flat Glasse without ye assistance of a liquor, I am much obliged to him for ye mentioning it. But though I had severall times observed it, before my Book came out; yet by reason of certain scruples I had about ye cause of it, I purposely forebore to take notice of yt, and another Phaenomenon somewhat akin to it."

In time, then, publication of scientific findings in science journals became accepted as a way of providing an enduring legacy. This had obvious appeal to prima donnas such as Boyle who pointed out grandly that it was a way to *"preserve the honor of ye invention for all posterity"*.

The interaction with peers was also the basis of the evolving quality assurance component of scientific correspondence – a fossil form of peer review. The job of reviewing the suitability of manuscripts for publication fell on the Secretary of the Society. The assessment procedure used by Oldenburg was a hybrid of two systems that continued into the 20th century and beyond. Articles were accepted when contributed by elected Fellows of the Society [a situation that still pertains to the *Proceedings of the National Academy of Sciences (USA)*]. In addition, the editor decided on the appropriateness of other manuscripts with input from knowledgeable Fellows. This was the quality assurance mechanism of some scientific journals until relatively recently, *e.g.* James McKeen Cattell edited *Science* from 1894 to 1945 and only consulted others to any significant extent from 1930. Even then he depended heavily on his son (a Harvard physiology graduate) for quality assurance. It was only in 1945 when AAAS took over the journal that they instituted formal peer review.

Quality assurance for the *Philosophical Transactions* was therefore rather informal, but the significance of disseminating reliable information was acknowledged. Then, as now, readers still complained at the poor quality of some published contributions. For example, one letter of to the Society complained about a premature report by saying *"one ought not to speak of them until the results have been seen; for it is not very urgent to know what*

charlatans may promise." - words that apply to many "rapid" scientific communications to this day!

The exact nature of critical review of manuscripts is one area that has changed in detail since the 17th century. The *Royal Society of Edinburgh* introduced a formal peer review system when it published *Medical Essays and Observations* from 1731. Formal peer review was instituted by the Royal Society when they took over official responsibility for the *Philosophical Transactions* in 1752 and established a "Committee on Papers" to review manuscripts. This committee was authorised to call in the assistance of any member of the Society who was especially skilled in the branch of science which was dealt with in any paper. As science has become more specialised the need for expert referees has increased. The second case in which the Royal Society called upon specific expert input was on 21st March 1831 when a paper by Sir Humphrey Davy was referred to Mr Michael Faraday; after this the employment of specialist referees was frequent.

Beyond 1670: scientific journals are established

A good illustration of the way in which publication in the Society journal had become established as a part of scientific communication is provided by correspondence with the greatest scientist of the day. On 8th February 1671 an entry in the Journal book records the receipt of a communication from Newton:[3]

> *"concerning his discovery about the nature of light, refractions and colours, importing that light was not a similar, but a heterogeneous thing ... and that whiteness is nothing but a mixture of all sorts of colours, or that 'tis produced by all sorts of colours blended together."*

The Council of the Royal Society then:

> *"Ordered that the Author be solemnly thanked, in the name of the Society, for this very ingeneous discourse, and be made acquainted that the Society think very fit, if he consent, to have it forthwith published, as well as for the greater conveniency of having it well considered by philosophers, as for securing the considerable notions thereof to the Author, against the arrogations of others."*

It quickly became clear that Oldenburg's journal was an important tool in fostering the growth of science. On his death in 1677 the journal was altered somewhat, but then resumed as the *Philosophical Transactions* in January 1683. The preface of the first new issue provided a comment about the significance of the journal and its relationship to the Society:[3]

> *"Although the writing of these Transactions is not to be looked upon as the business of the Royal Society, yet in regard they are a specimen of many things which lie before them, contain a great variety of useful matter, are a convenient Register for the bringing in and preserving many experiments which, not enough for a book, would else be lost, and have proved a good ferment for the setting of uncommon thoughts in all parts a-work."*

The scientific journals had joined books in becoming an established medium for public scientific communication and debate and were headed to become the core archive of scientific discoveries.

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Inorganic and Organometallic Specialist Group Conference Scholarships

IC-03 Conference Of The Inorganic Chemistry Division, Royal Australian Chemical Institute

The NZIC Inorganic and Organometallic Specialist Group of is offering a limited number of scholarships to postgraduate students wishing to attend the IC-03 conference organized by the Inorganic Chemistry Division of the Royal Australian Chemical Institute. It will be held at the University of Melbourne, 2 – 6 February 2003.

Postgraduate students (PhD and Masters) of a New Zealand university who are members of the NZIC and who are intending to present a paper or a poster are eligible to apply for a scholarship of up to $NZ500. Applications, in writing, should include the following:

- a brief curriculum vitae of the applicant
- a confidential recommendation from the supervisor (to be sent separately)
- an abstract of the paper or poster to be presented
- a budget for attendance at IC-03 showing projected expenses and other sources of support.
- NZIC membership number

Applications, which must be received by 31 October 2002, should be sent to:
Dr David Weatherburn,
Chairperson - IOSpG,
School of Chemical and Physical Sciences,
Victoria University of Wellington,
P O Box 600 Wellington

Current Issues In The Scientific, Technical, And Medical Publishing Industry

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The Scientific, Technical, and Medical (STM) publishing industry produces works for and by scientists. It is unique and interesting in the way material is acquired, the way the sales, marketing and distribution functions are conducted, the audience it is intended for, and the form of the finished product. The industry has been profoundly affected by the electronic revolution on the published product. The current state of the industry is discussed with particular reference to this.

What Are STM Publications

University faculty and the staff of government research agencies and private research institutions write the publications. They record procedures and research developments in the areas of the pure and applied sciences, technology, medicine, and the life and social sciences. Such publications are the principal way these results are made available to other members of the scientific community and the general public.

Perhaps the most important type of STM publication is the "Journal". This is a periodical that reports raw research results and analyses in the form of papers. They are considered in more detail below. Other STM publications, which include reviews, monographs, reference works, encyclopaedias (also considered below) and databases, can generally be regarded as a synthesis of the primary information found in journals. Together these make up the bulk of the works collected in the libraries of universities and other research institutions.

STM publications aim to stimulate discussion of the information being reported and the subject in general, and provide platforms for further research—researchers make use of the results and the methods reported in their own work or they may replicate the tests themselves.

A unique step in the publication of STM works is the peer review process. Before being accepted for publication, a submitted report will be reviewed by 1, 2, or more qualified but (usually) unpaid and anonymous referees chosen by the editor. The referees comment critically on the validity of the paper, determine whether the scholarship and results being reported are of sufficient importance for inclusion in the particular work, and on the degree of interest the work is likely to hold for the audience.

The benefit to researchers and the institutions in which they work of producing work for publication, especially journal articles, cannot be underestimated. It enables researchers to share findings, advance research enquiry, and influence the thinking of others. As Guédon[1] describes it, "the publication of research in scholarly works enables a researcher to gain visibility, authority and prestige".

Perhaps most importantly, publication is a vital step in obtaining funding and promotion. Keller[2] describes this relationship as a complex cycle that continues *ad libitum*:

> "An investigator obtains funding to do research which results in scientific papers being prepared and published. Having papers published is a quality stamp on the research and increases the researcher's credibility and prestige, meaning they are in a better position to obtain funding in the future. The basis for promotion in an academic environment is the researcher's ability to obtain funding and their contribution to the body of knowledge in their research area as measured by the quality and quantity of their peer reviewed, published reports."

For research institutions such as a university these publications are also very important. The number and quality of the papers published by its employees serves as an indicator of the quality of research performed within it which, in turn, impacts upon the ability of the institution to attract students, researchers and funding. According to Wyly,[3] "only by making the intellectual products of the university known can they be valued and financially sustained by the supporters of scholarly enterprise, ranging from corporations to foundations to legislators to other scholars".

As well as providing a home for the research reported in STM publications, the universities and research institutes are the primary customers of these works. In fact, institutional customers comprise 60-70% of the purchasers of STM journals.[4]

One of the most interesting and controversial aspects of STM publishing is the general inelasticity of the marketplace and the lack of competition in it. The major impediment to competition is that authors want to publish in the best-known, most widely recognised publications, regardless of their cost to customers. This ensures that they gain the greatest visibility and the best evaluation of their work. However, the customer is not free to choose between publications because according to Wyly[3] each product is a 'must-have' and 'single-source'. This combination of circumstances means that publishers are able to increase prices of their publications at will, resulting in the current trend where libraries are forced to pay more (often from relatively fixed budgets) while subscribing to fewer titles. This, in combination with the practice of some publishers of indiscriminately increasing the number of titles published, is referred to as the serial crisis.

Types of STM Publications

Journals

Journals are published by many different organisations worldwide. Today they exist in both print and/or electronic form. Two of the most highly respected journals in the natural sciences are *Science*, published weekly by the American Association for the Advancement of Science in Washington DC, and *Nature* published weekly by The Nature Publishing Company in London.

Most journals are published according to a similar model: the publishers employ researchers in the area as editors, who in combination with an editorial board are responsible for determining the editorial direction of the journal and maintaining its quality and profile. Content is provided free of charge in the form of papers that are submitted by researchers. Before being accepted for publication by the editors the papers are subject to a peer review process facilitated by the editors, but actually performed by independent referees as described above. The editorial board may become involved in providing advice on whether to publish a specific paper if problems such as conflicting referee reports are obtained and it also participates in the appeals process that can occur when a paper is rejected.

Some journals specialise in the rapid publication of short articles often called letters or (brief or rapid) communications. In the discipline of chemistry, this function is performed by *e.g.* the British-based Royal Society of Chemistry's (RSC) *Chemical Communications*. Others, such as the American Chemical Society's (ACS) *Journal of the American Chemical Society* focus on full-length publications but also include communications. Still others concentrate on review papers that summarise the state of a particular aspect of research at a point in time, and they usually provide a full list of relevant references. In many of these types of journals, such as in *Reviews of Modern Physics*, the editors commission the articles. Journals also often publish comments and replies, the former are critical responses to previously published papers and the latter are the responses of the original authors to the criticism.

All the journals mentioned in the previous paragraph publish papers from all areas within the discipline. Others, such as the Elsevier *Journal of Supramolecular Chemistry* or the RSC's *Journal of Materials Chemistry* have a much narrower focus.

In all the disciplines covered by STM publishing there is a wealth of research continuously being reported in a huge number of journals around the world. In order to make use of the information researchers use two techniques. Arguably the most common method is simply to browse through a selection of current journals. However, the content of journals are also indexed in print, electronic (diskette, FTP and CD-Rom), and web-based works. These include the Institute of Scientific Information's (ISI)[5] *Current Contents*, *Science Citation Index* and *Social Science Citation Index*, and the ACS[6] *Chemical Abstracts* and they enable scientists to search the literature more systematically.

The ISI products provide records about articles (and editorials, meeting abstracts, commentaries and other significant items) from current and past editions of a large number of journals (over 8,000 in the case of *Current Contents* and over 3,700 in the *Science Citation Index*). Among the information captured about each article are the author addresses, abstract and (unique to this latter product) the reference list cited in the article. This latter information allows users to search for articles that cite a known work. *Chemical Abstracts*, which comes out weekly, provides abstracts from journal articles and patents as well as author, keyword and patent indexes. Every six months, author, patent, general subject, chemical substances, formula volume indexes are published.

In order for librarians and researchers to manage their journal collections and for researchers to decide to where to submit their work, journals are ranked according to their importance within their subject category. Such ranking systems also act as market research tools for publishers. One way that journals are ranked is according to their ISI impact factor, which is published in the *Science* and *Social Science Citation Indexes*. This factor gives the frequency with which an average article in a journal has been cited in a particular period and is calculated by dividing the number of current year citations by the number of citable items published in the previous two years. According Eugene Garfield (Founder and Chairman Emeritus, ISI)[7] this number is a "quantitative tool for ranking, evaluating, categorising and comparing journals". However, he stresses that they must be used with "careful consideration of factors that affect citation rates (for example, the abundance of review articles in a journal) and in conjunction with informed peer review".

Encyclopaedias

Encyclopaedias are collections of between 200 to 600 entries, which as whole, are intended to cover comprehensively a particular subject area. As with journals, these days encyclopaedias are likely to be published on the web, where articles can be accessed using search engines, as well as in traditional book form with entries arranged alphabetically. Web publication is particularly advantageous in these cases due to the potential size of the print version and the ease with which they can be updated—most encyclopaedias are updated on the web within six months of publication including new entries.

Each entry, which is likely to be between 1,500 and 4,000 words, is intended to be a brief review of an aspect of the subject such as terminology, concepts, or applications. Each aims to provide important citations and usually include illustrations and graphics to increase the ease and speed with which the article can be understood.

Encyclopaedias are aimed at students and general scientists who would like to become more familiar with the area as well as specialist browsing for new results, ideas, and insights. However, the idea of these encyclopaedias has

proven to be controversial within the scientific community with some claiming that they are simply a way for publishers to make even more money. Critics claim that the products do not have an audience and that they are only cost effective for publishers because of the inelasticity of the STM market – because encyclopaedias exist libraries feel compelled to buy them.

On the other hand, those who support them claim that they have an important role in the dissemination of scientific knowledge. Since they reach a wider audience than a standard journal article (Steed[8] believes that only 3 or 4 people read any given journal article thoroughly), such works serve to raise the profile of the authors and the area of research, which in turn may increase funding.

Many publishing companies produce such works including Academic Press—*Encyclopaedia of Reproduction*, Nature—*Encyclopaedia of Life Science*, and Marcel Dekker, which will publish among others the *Encyclopaedia of Pharmaceutical Technology* and the *Encyclopaedia of Pest Management* (Table 1).

Who Are The STM Publishers

STM Publishers can be divided into two types. First, the (generally) smaller not-for-profit presses whose primary aim is to serve a particular community of people. These are the university presses, such as Oxford University Press, and the learned society publishers such as the UK-based RSC and the American Physical Society. In these cases the revenue obtained from publishing is generally channelled back into the community for their benefit. For example, according to the editor-in-chief of *Plant Physiology*, published by The American Society of Plant Biologists, the revenue generated by that journal is used, among other things, to lobby congress for appropriations in science and to give awards recognising outstanding teachers and researchers.[9]

Commercial publishers have only been a force in STM publishing since the 1960s when the cold war resulted in an enormous expansion of literature in many new disciplines. The societies were at this time neither willing nor able to accommodate the increase in literature in non-traditional subjects; so commercial publishers were able to establish themselves. Today, the major commercial players include Reed Elsevier, Taylor & Francis, and Wolters Kluwer.

Most researchers believe that society publishers provide a product that is better value for money. Bergstrom[10] found that across all disciplines, commercial journals cost considerably more than the corresponding societal journal while being of lesser quality (they consistently have less citations). For example, the six most cited economic journals listed in the *Social Science Citation Index* are all non-profit journals and their library subscription prices averaged about $180 per year. Commercial publishers own only 5 of the 20 most cited journals, but these have an average price of $1660. Bergstrom also showed that average real price per page increased between 1985 and 2001 by about 50% for the non-profit journals and by 173% for the commercial journals!

Consolidation

In recent years all areas of commercial publishing have been subject to consolidation. The STM sector has not escaped this trend and through acquisitions and mergers many STM publications owned by commercial interests have been concentrated into very few hands. For example, The American Chemical Society, the world's largest scientific society, controls just 26 journal titles, compared to Reed Elsevier, which now controls over 1,500 titles and Taylor & Francis, which controls over 800.

One of the most recent examples of consolidation is the acquisition by Reed Elsevier of Harcourts, which was

Table 1. **Selected Encyclopaedias in print**

Publisher	Encyclopaedia	Price of paper product	Price of Internet product
The Nature Publishing Co.	Encyclopaedia of Astronomy and Astrophysics	2, 500 pages, list price $650	1-year personal subscription $200
The Nature Publishing Co.	Encyclopaedia of Life Sciences	List price $4,200	1-year personal subscription $500 Institutional Prices vary but academic libraries, prices start at $1,500 High School Libraries $600
Academic Press	Encyclopaedia of Reproduction	4,768 pages, list price $661.95	N/A
Marcel Dekker Inc.	Encyclopaedia of Pharmaceutical Technology, 2nd edition	3 volumes, list price $850	1-year personal subscription $99.75 Institutional Price $975
Marcel Dekker Inc.	Encyclopaedia of Pest Management	903 pages, list price $250	1-year personal subscription $59.75 Institutional Prices depend upon number of users

completed in July 2001. This acquisition was actively opposed by many including the UK-based Consortium of University Research Libraries.[11] A report from the UK Office of Fair Trading[4] expressed concerns about the size of Elsevier's share of the journal market and potential impact of the proposed merger. The company reportedly has a global market share of 22.8% and in some subject areas it is considerably higher.[12] The report[4] noted that both parties published high quality journals and so the number of competitors in market of such journals would be reduced.

Many believe that consolidation has contributed to the reduced competition in the journal market as discussed earlier. This, in turn, has caused journal prices to rise at a rate disproportionate to any increases in cost or quality. By taking an in-depth look at the finances of three major publishers of STM, in particular their high return on equity, Wyly[3] and Hipps[13] showed that Reed Elsevier, Wolters Kluwer, Plenum Publishing, and John Wiley & Sons were operating in an inherently non-competitive market during 1998 and 1999. A consequence is the fact that Reed Elsevier has been able to increase the prices of its journals by 10% annually for the years 1995-1999.[4]

Commercial publishers often respond to assertion of reducing competition by noting that the barriers to entry into journal publishing are not significant. While large amounts of capital may not be needed to start up a journal, authors have an interest in publishing in the most well reputed journals, meaning that it is almost impossible for new entrants to attract high quality editors and authors and to develop a subscriber base.

Response To The Serial Crisis

The pricing practices in combination with that of continuously expanding the range of STM materials commercially published has been referred to as the serial crisis[1,2] and has bought commercial publishers under fire from the researchers who provide the material for the publications. In response, some interesting schemes aimed at reducing the dependence of research institutions on the products of commercial publishers have emerged.

One is the formation of consortia of research libraries, for example the Canadian National Site Licensing Project (CNSLP).[14] By working together these groups have been able to provide participating libraries with a range of titles at a reasonable price. However, as Guédon[1] points out, such schemes are potentially counterproductive because they may allow big publishers, through deals where they package large numbers of their titles, to promote their journals at the expense of other smaller publishers.

The Scholarly Publishing and Academic Resources Coalition (SPARC)[15] is a UK-based alliance of research institution libraries that promotes competition in the STM publications market by encouraging the introduction of alternative scientific communications outlets at fair prices by guaranteeing a subscription base and helping to market new products to potential subscribers. One of these SPARC-supported journals that is proving very successful, is *Organic Letters* published by the American Chemical Society as an alternative to the Reed Elsevier *Tetrahedron Letters*.

This approach also has critics among those who support the scheme on principle. They argue that creation of these journals serve only to stretch research libraries resources even further - libraries feel the need to subscribe to both the high price original and the lower cost equivalent.

The third type of schemes is the open archive projects and is discussed later.

Some believe that the cure for the exploitation of scientific research by commercial publishers lies with the learned societies and university presses themselves. Keller[2] suggests that learned societies need to be "quicker and more responsive in serving the communication needs of newly developing sub-communities of scholars". In order to facilitate this, organisations such as HighWire Press[16] have emerged to help societies and associations manage the transition to digital publishing. This particular organisation, the electronic imprint of Stanford University Libraries, produces and manages the online versions of journals for societies such as The American Society for Biochemistry, Molecular Biology (*Journal of Biological Chemistry*) and the National Academy of Science (*Proceedings*).

Bergstrom[10] agrees that society and university presses must be more responsive and uses the American Medical Association (AMA) as a model of how this can occur. At this institution, a paper submitted to the *Journal* and rejected as being too specialised by reviewer, is automatically re-routed to the appropriate specialised AMA journal where it can be accepted on the basis of the original reviews or additional reviews can be obtained. A similar feature applies with the *Journal of the American Chemical Society*.

Bergstrom[10] also suggests a more extreme course of action where entire editorial boards leave an existing high-price commercial journal and start up an equivalent journal under the banner of an existing learned society or university press. Examples of this have already occurred. When the Editorial Board of Elsevier's *Journal of Logical Programming* failed to convince the publisher to reduce the library subscription price, the entire group resigned and founded a new journal, *Theory and Practices of Logic Programming*, under the banner of Cambridge University Press.

STM Publishing And The Internet

Changing The Publication Mode

Scientists were quick to recognise the potential for the Internet to free-up access to scientific research by making it more cheaply, quickly and widely available. However, the response of many commercial publishers to the Internet, seeing their control of content and profits at risk, has been to tighten their hold over copyright and dissemination of material and to increase prices compared to the paper product.

Traditionally, the most important tasks of STM publishers have been the facilitation of reviews for articles and their distribution in the form of journals and encyclopaedias. It is this latter function that is directly under threat from the Internet. The Internet has the potential to change the entire model of distribution of scientific information from the journal mode—controlled by publishers with articles collected under a brand name—to an archive mode where articles stand alone and are published on the Internet by their authors.

To facilitate this, electronic agencies, other than journals, are springing up to facilitate peer review functions. These include www.biomedcentral.com and www.thescientificworld.com that allow certified articles to be published directly on the web by their authors. They may very quickly become the method of choice for researchers whose articles are too specialised to be of interest to the currently established journals.

Thus, it seems likely that journals that do not add value to content in new ways may not survive. The editors[17] of the *British Journal of Medicine* (*BMJ*) suggest that value can be added by:

- providing information their readers actually want in an exciting way
- digesting and synthesising the research
- beginning to turn it from information to knowledge
- educating their readers, particularly on new subjects which will change their lives
- setting agendas
- encouraging debate within the community.

Value Added By The Internet

The Internet is also changing STM publishing in more immediate and less extreme ways. Most journals and encyclopaedias are now available online as well as in print. Features of the online versions, which are fast becoming standard, include the provision of access to current articles prior to print publication, *i.e.* as soon as they are accepted, acting as a forum for instantaneous reaction to articles, and providing links to other useful and relevant sites.

In terms of this last point, the Internet has the potential to tailor an article to suit the needs of both the general reader and expert by providing links to tables of results, graphics and more detailed explanations, which may only be of interested to the latter group. An example of this is the RSC's Electronic Supplementary Information (ESI) service[18] where information is posted by authors whose articles have been accepted by the RSC journals. The RSC believes this service allows authors to enhance and increase the impact of their journals.

The Internet is facilitating secondary publishing ventures such as abstracting and indexing that aim to enhance the efficiency of browsing, searching, and reading scientific literature. One of the most significant of these is a 1999 publisher's initiative called CrossRef.[19] This scheme uses metalinks to enable researchers to move simply by "clicking" from one journal article to another cited one, usually located on another server and published by another company - each publisher sets its own access standard for its own material. Founded by a group of 12 publishers including both commercial and not-for-profit organisations, 112 publishing companies currently subscribe to this service. CrosssRef already has 3 million articles linked and is adding 700,000 annually.

Another feature made possible by the Internet is the preprint server. The template for these is the Los Alamos (now Cornell) Archives, a physics pre-print server which provides a place for authors to post work before it is submitted to a publisher.[20] The articles, which remain the property of the author, are freely and permanently available and can be updated by the authors. Now even Reed Elsevier is getting in on the act by hosting the Chemistry Preprint Server, an archive of preprints destined for chemistry journals.

Many publishers are now also producing journals that are online only. These tend to be in highly specialised area, for example, the RSC *Geochemical Transactions*.

Open Archives

The Public Library of Science (PLoS)[21] is an organisation of scientists aiming to free-up access to scientific and medical literature for both scientists and the public. This will be, they believe, to the benefit of scientific progress, education, and the public good. In order to promote this goal, the group is circulating a letter where signatories show their support for this so called 'open access' to scientific publications. By signing, they also pledge to publish in, edit or review for, and personally subscribe to only those journals that grant unrestricted distribution rights by independent or free libraries of science.

One of the first incarnations of the free libraries advocated by PLoS is PubMed Central (PMC), established in 1999.[22] This scheme, funded by the US National Institute of Health, was originally intended as a central repository for literature in the life sciences. However, failure to attract sufficient content meant that in 2001 it was downgraded to an indexing and linking service, with the actual content remaining on publishers' websites.

To populate PMC, all life science journals are asked to provide access to their content free of charge after a period following print publication. The delay is intended to reduce the effect on subscriptions that would result from entirely free access. However, according to PMC rules this period must be less than one year and the organisation is encouraging publishers to share content immediately, or at least within six months. Among the journals that have joined are the *BMJ* and the *Proceedings of the National Academy of Sciences of the United States of America*.

The editors of the *BMJ*[17] see their joining this scheme as being advantageous both for their authors (wider dissemination of material) and the journal itself. They anticipate that users will jump from PMC to BJM.com to download PDF versions of articles and to access accompanying editorials, commentaries, and rapid responses, greatly increasing traffic to their own site.

Many publishers are sceptical that PMC and other such free access schemes will succeed. In his address at the Freedom of Information Conference in July 2000 held at the New York Academy of Medicine, Pieter Bolman[23] from Academic Press suggested that changing the economic and access model for scientific communications simultaneously is asking for trouble. He also questioned the desirability of the US government becoming involved in the private sector.

Again, the scheme has critics even among those who think its aims are noble. Keller,[2] for example, believes that the scheme will have the effect of further weakening the competitive position of scholarly society and university presses while having little effect on the commercial publishers since they are unlikely to join them.

Conclusion

The STM publishing industry is in a tremendous state of flux. The Internet is forcing publishers and researchers alike to re-evaluate their role in the publishing process. Publishers are reacting to the threat of loss of control by tightening up access to their products while at the same time releasing they must add value to these if they are to stay vital. Researchers are questioning the very need for publishers and are exploring ways to cut out this middleman. What the equilibrium state will be and when it will be reached remains any ones guess.

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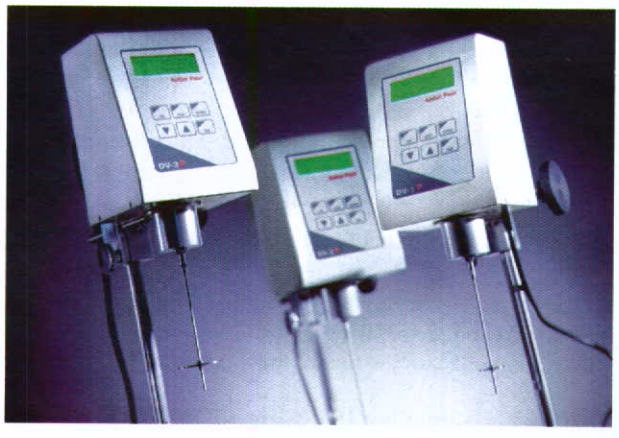
Anton Paar Digital Viscometers

Viscosity measurements are not only required in research and development, they are progressively important in industrial quality control. The DV-P series fulfills these requirements. Anton Paar's Digital Viscometers are extremely versatile, robust and easy to use. The DV series and accessories are based on the well-known "Brookfield™" standard and are therefore very suitable for replacing old analog viscometers where a scale has to be read manually. Accessories are available to measure samples as diverse as juices and pastes.



The DV-P viscometers measure the resistance of a spindle rotating in the sample. The flow viscosity is then calculated automatically from this torque measurement, the spindle geometry and the rotational speed.

Highlights of the DV-P series are:

- New magic coupling for true one-handed spindle attachment.
- Optional accessories for low viscosity or small sample volumes. A helix drive unit for pastes and gels.
- Flow jackets available for precise temperature control.
- Speed changes can be made during measurement.
- Auto ranging
- Auto self-test function
- Over / under range sound alarm.

Contact: MEP Instruments Ltd
P O Box 113-125 Broadway, Auckland
Phone: (09) 3661236, Fax: (09) 3661235
Email: info@mep-instruments.co.nz
Internet: www.mep-instruments.com
circle number 21 on the reader reply card

Shimadzu Thermogravimetric Analyser

The Shimadzu DTG-60/60H adds flexibility and performance to the basis functions required by simultaneous thermogravimetry/differential thermal analysis. (TG/DTA).

Atmospheric control is programmable. The TA-60WS workstation provides advanced acquisition, analysis and report functions, which ensure comfortable simultaneous measurement. The balance assembly has an X-shaped fulcrum that provides high sensitivity and a vibration-proof structure. A/D technology allows the DTG-60/60H to operate in a large dynamic mass range and the DTG-60/60H offers differential weight measurement.

The DTG-60/60H provides a true DTA set up. The sample and the reference position are located at the ends of the balance beam. This differential balance system minimizes baseline drifts caused by buoyancy or convection during the heating process, ensuring a stable baseline even at high temperatures.

During TG-DTA measurements, qualitative and quantitative analysis, examination of reaction mechanisms and evaluation of heat resistance are performed by studying various reactions and interactions between a sample and special atmospheres. The channel structure of the DTG-60/60H offers the solution for these applications. While an inert gas purges the balance, reactive gases are directly connected to the reaction pan. In combination with the FC-60A, the measurement is fully software controlled.

The DTA detector of the DTG-60/60H is well balanced between sensitivity and resolution. Since symmetrical arrangement of two detectors in the furnace provides good temperature distribution, even very small DTA signals, such as noise and drift, are well matched. Using the convenient plug-in method, the DTA detector can be quickly replaced.

Contact: Shimadzu Scientific Instruments
Freephone 0800 12 SHIM (0800 12 7446)
Email: sales@shimadzu.co.nz
Internet: www.shimadzu.com.au
circle number 22 on the reader reply card

TA Instruments Introduces A High-Efficiency Liquid Nitrogen Cooling System (LNCS) For Q Series Differential Scanning Calorimeters.

High performance and high flexibility, with an exceptional 140 °C/min cooling rate, make the LNCS ideal for polymer isothermal crystallization studies.

TA Instruments, Inc. brings new efficiency and flexibility to cooling of TA Instruments Q Series Differential Scanning Calorimeters (Q1000, Q100)with the introduction of the new Liquid Nitrogen Cooling System LNCS, a high performance cooling accessory.

The LNCS delivers excellent low temperature performance (to -180 ° C), with an

exceptional cooling rate capacity (up to 140 ° C/min), and the ability to operate efficiently at temperatures up to 550 °C. It can provide instantaneous cooling and rapid turnaround, making the LNCS ideal for polymer isothermal crystallization studies. An autofill feature enables the LNCS to be refilled automatically from a larger liquid nitrogen source, to enable continuous DSC operation.

Contact: TA Instruments, Inc.
109 Lukens Drive, New Castle, DE 19720, USA
Phone: (+1-302)-4274000, Fax: (+1-302)-4274001
Email: info@tainst.com
Internet: www.tainst.com
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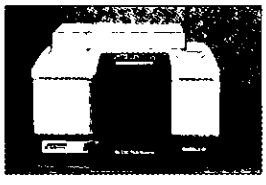
New Entry Level FTIR Spectrometer

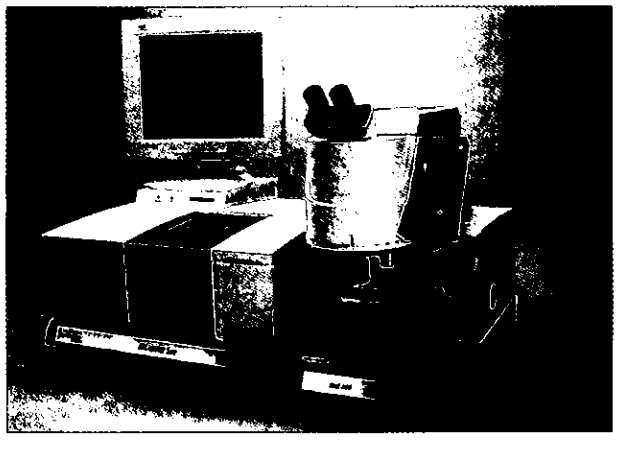


A.i. Scientific is proud to introduce the Digilab Scimitar FTIR spectrometer, a new spectrometer designed for laboratories that do not require the flexibility and upgradeability of Digilab's renowned Excalibur Series spectrometer. Derived from the legendary Excalibur platform, the FTS-2000 Scimitar spectrometer features a full size sample compartment enabling all industry standard sampling accessories to be used. As the Scimitar shares the Excalibur technology, it's spectroscopic performance ensures that virtually all sampling techniques such as attenuated total reflectance, specular reflectance and diffuse reflectance can be performed without a compromise in the confidence of your results. The instrument comes standard with a multimedia training CD-ROM, Merlin software, which is a full-featured spectroscopic data collection and analysis program that includes the ability to perform simple quantitative analysis. Digilab's Merlin software provides complete sample tracking and audit trails for GMP and 21 CFR part 11 compliance.

Contact: Ai Scientific, Freephone 0800 08 60 60
Email: aimail@aiscientific.com
circle number 24 on the reader reply card

FastImageIR, Digilab's New Affordable Spectrochemical Imaging System

Ai Scientific is pleased to announce the next breakthrough in spectrochemical imaging, the Digilab FastImageIR. This new imaging system uses the UMA 600 designed for both imaging and single-point analysis, the proprietary Lancer focal plane array detector and the affordable rapid scan spectrometer, Excalibur.



The FastImageIR provides solutions in a variety of industries. From the ability to study drug dissolution in real-time and also gain spatial information, to the ability to detect forgeries in works of art by identifying paint binders, the FastImageIR provides diverse solutions in polymers, pharmaceuticals, oils, cosmetics, forensics and semiconductors. The FastImageIR actually allows the researcher to apply the power of spectrochemical imaging to kinetic processes. Spectral, spatial and time information can now be determined on dynamic systems.

This new family of instruments provides another data dimension for the research community. The FastImageIR system can acquire a data cube of full range IR spectra at 8 cm^{-1} in less than 10 seconds per data cube. In fact at 8 cm^{-1} a data cube that represents one scan, 1024 spectra, can be collected in under one second. The FastImageIR is based on Digilab's developments in focal plane arrays that match the performance of the detector to the spectrometer, resulting in a system optimized for spectroscopy.

Contact: Ai Scientific, Freephone 0800 08 60 60
Email: aimail@aiscientific.com
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Shimadzu IRPrestige-21 FTIR

Shimadzu 's new FTIR, the IR Prestige-21 offers an expandable wavelength range from near IR to far IR (12,500 to 240cm^{-1}) and features the world's highest S/N ratio at 40,000:1 or higher. This has been achieved with a high sensitivity DLATGS detector, high throughput optical elements and a high intensity ceramic light source.

Running under Windows 2000, the 32-bit IR Solution software offers FDA 21CFR Part 11 compliance with security enhanced by obligatory entry of a username and password at startup and the function to allow the use of electronic records and electronic signatures. Other features include atmospheric correction, flexible layout report generator, macro programming, self diagnostics and monitoring, GLP/ CFR Part 11 compliance, and a high speed IEEE1394 interface.

The Advanced Dynamic Alignment (ADA) system ensures the stability of the interferometer by keeping the interference conditions continually optimized during measurement. This feature ensures high stability and minimizes instrument maintenance. The instrument incorporates triple protection to prevent deterioration of the beam splitter with a sealed interferometer, coated KBr plates with a moisture proof protective film and the use of an autodryer to reduce humidity.

Ease of use is provided by the Automatic Accessory Recognition feature, which automatically recognizes an accessory when it is installed, sets a suitable method and validates it, and reports the result. Two detector and two light sources can be mounted simultaneously. A range of QuickStart accessories are available.

Contact: Shimadzu Scientific Instruments
Freephone 0800 12 SHIM (0800 12 7446)
Email: sales@shimadzu.co.nz
Internet: www.shimadzu.com.au
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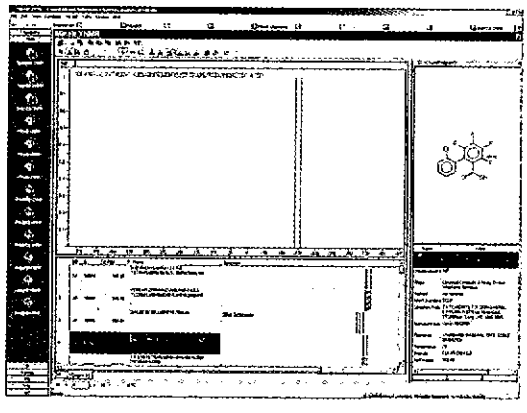
Addition Of New Databases Bring Bio-Rad's Spectral Collection To Over 800,000

Bio-Rad Laboratories, Informatics Division, the world leader in spectral databases, announces the addition of several new spectral databases to their already extensive collection, bringing the total number of spectra to over 800,000. Marie Scandone, Bio-Rad Laboratories Informatics Division Database Product Manager comments, "With the world's largest collection of spectral data, Bio-Rad is continually dedicated to providing the highest quality spectra and most extensive content to the scientific community." New databases that have been added to Bio-Rad's HaveItAll data subscriptions include:



- Chemical Concepts MS Database of Industrial Compounds
- Chemical Concepts MS Database of Volatile Compounds in Food
- Chemical Concepts MS Database of Geochemicals/ Petrochemicals and Biomarkers
- Chemical Concepts MS Database of Androstanes and Estrogens And Other Steroids
- Chemical Concepts MS Database of Drugs
- Chemical Concepts CNMR Database of Organic Compounds
- Chemical Concepts CNMR Database of Flavours and Fragrances
- Chemical Concepts CNMR Database of Natural Products
- Chemical Concepts HNMR Database of Organic Compounds
- Chemical Concepts ^{19}F-NMR Database
- Chemical Concepts ^{31}P-NMR Database
- Chemical Concepts ^{15}N-NMR Database
- Chemical Concepts ^{17}O-NMR Database
- Chemical Concepts ^{29}Si-NMR Database
- Wolfgang Robien, University of Vienna Database of ^{19}F-NMR Spectra
- Wolfgang Robien, University of Vienna Database of ^{31}P-NMR Spectra
- Wolfgang Robien, University of Vienna Database of ^{15}N-NMR Spectra
- Wolfgang Robien, University of Vienna Database of ^{17}O-NMR Spectra
- Wolfgang Robien, University of Vienna Database of ^{29}Si-NMR Spectra

- Wolfgang Robien, University of Vienna Database of ^{11}B-NMR Spectra.

Contact: Deborah Kernan, Bio-Rad Laboratories, Informatics Division, Phone: (+1-215)-349-7366
Email: deborah_kernan@bio-rad.com
Internet: http://www.informatics.bio-rad.com
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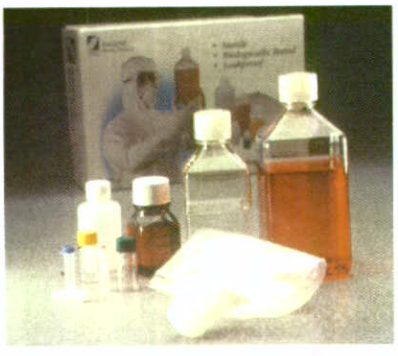
Comprehensive Offering Of NALGENE® Sterile, Leakproof, Biologically-Tested Packaging Products Detailed In Brochure, On Web Site

More than 100 items for pharmaceutical, biotechnology, cell culture and diagnostic reagent packaging applications displayed in print and on-line.



New literature and a web site display more than 100 sterile, leakproof, biologically tested NALGENE packaging products including PETG/PET Media Bottles, B^3 Media Bags™, HDPE Narrow-Mouth Bottles, PETG Serum Vials, Biotainer™ Bottles and Carboys, and Micro Packaging Vials. Designed and manufactured in an ISO 9001-certified environment, the NALGENE Sterile Packaging Product line is a comprehensive offering for pharmaceutical, biotechnology, cell culture and diagnostic reagent packaging applications.

Both the 12-page literature (P20071) and www.nalgene-packaging.com detail the NALGENE Sterile Packaging Products range in capacities from 0.5 mL to 20 L. These include the unique NALGENE neck and closure design that require no liner or gasket to assure repeatable leakproof performance. Biologically-tested to meet current industry standards, NALGENE products are non-cytotoxic, and comply with tests including US Pharmacopoeia Class VI and USP 24<661>. FREE SAMPLES can be ordered online.

To request a free copy of the new NALGENE Sterile Packaging Products brochure:

Contact: NNI Documentation Centre, Sevenoaks, Kent TN14 5XA, United Kingdom, Fax: (+44-1732)-453166
Internet: www.nalgene-packaging.com
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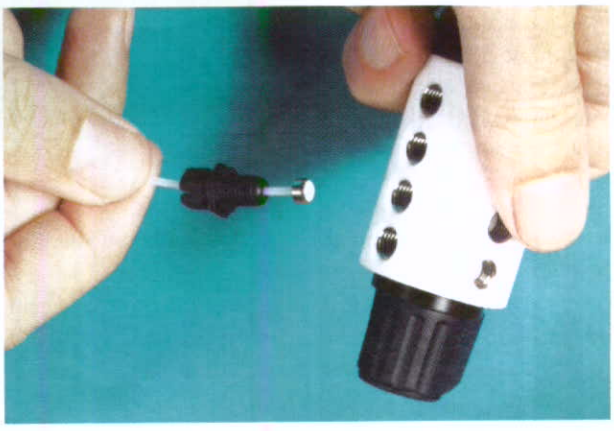
New Grippers Offer Zero Dead Volume For High Pressure Applications

Omnifit's unique gripper fittings for connecting laboratory tubing offer zero dead volume at pressures up to 1000 psi. They can be hand-tightened without the need for a special tool and will not compress or twist tubing if over-tightened.



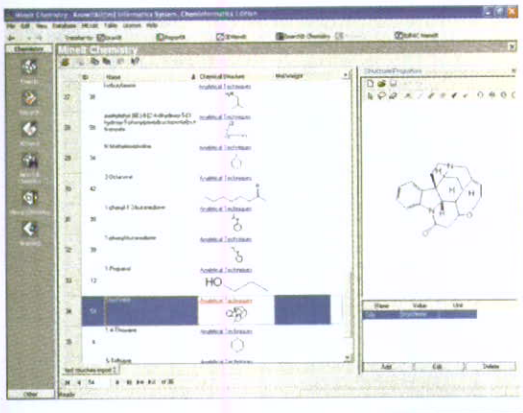
They have a chemically-inert PTFE washer which is press-fitted into a 316 stainless steel housing, ensuring a leak-free connection with minimum disturbance to the fluid path. They can also be repeatedly connected and disconnected without any deterioration to the sealing face.

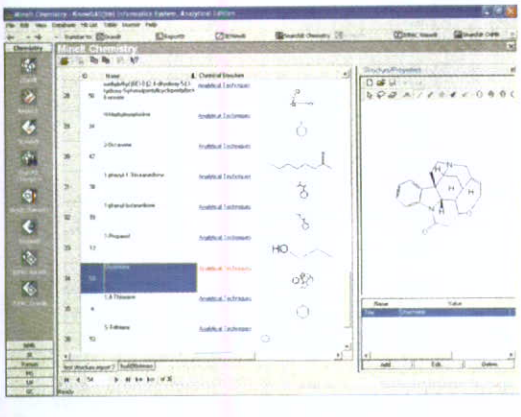
The gripper's polypropylene fitting is available in ten standard international colours and has a slotted head for easy removal. A built-in locknut prevents the fitting from coming loose.

Contact: Omnifit Ltd, Fax: (+44-1223)-416787
Email: sales@ omnifit.co.uk
Intyernet: www.omnifit.co.uk
circle number 29 on the reader reply card

Bio-Rad Releases KnowItAll 2.0 For Chem And Analytical Informatics

Bio-Rad Laboratories, Inc., Informatics Division announced the release of version 2.0, a major upgrade to their KnowItAll™ Informatics System. KnowItAll is the most complete collection of software tools and data for multiple spectral techniques and cheminformatics all





within one interface. The latest release of KnowItAll offers the following new features and options:

- Ability to draw store, and search complex mixtures of stereoisomers, including enantiomers and diastereomers
- 3-D structure viewing capability
- Software option to search XNMR databases
- Software option to build XNMR databases with assignments
- Software and database license activation via the web
- Network installation option
- HaveItAll® NMR and MS spectral database subscriptions include more data
- New HaveItAll spectral data subscription available for ^{19}F NMR, ^{31}P NMR, ^{15}N NMR, ^{17}O NMR, ^{29}Si NMR, and ^{11}B NMR.

Gregory M. Banik, PhD, Bio-Rad Laboratories, Informatics Division, General Manager comments, "Such a complete and flexible informatics product as KnowItAll is unique in the marketplace. KnowItAll allows users to choose solutions that are right for them and later expand as needs arise in the laboratory. Bio-Rad is continually adding new software and database solutions to the KnowItAll product line and is committed to taking scientists down new paths in informatics."

Contact: Deborah Kernan, Bio-Rad Laboratories, Informatics Division, Phone: (+1-215)-349-7366
Email: deborah_kernan@bio-rad.com
Internet: http://www.informatics.bio-rad.com
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digestec
Pressure Digestion Systems

Features:

- Pressure digestion vessels made of high quality stainless steel, tested by the German TÜV several times
- Inserts made of pure, isostatically pressed PTFE or quartz glass
- Inserts ranging from 10 to 250 mL.

Use:

Sample preparation for AA, ICP, ICP-MS. The digestions can easily be integrated into the everyday work of the laboratory and also may run overnight. This way they do not occupy resources, which are needed in other areas of the laboratory. Useful in all areas, such as petroleum chemistry, pharmacy, environmental analysis etc.

Specification:

Type	Volume	P_{max}	T_{max}
DAB-2	50 mL	200 bar/2900 psi	250 °C
DAB-3	250 mL	200 bar/2900 psi	250 °C
DAB-4	10 mL/25 mL	200 bar/2900 psi	250 °C
DAB-5	50 mL/80mL	200 bar/2900 psi	250 °C

Accessories:

Heating, inserts made of PTFE, TFM, temperature control, multiple vessel system.

Contact: GBC Scientific (NZ)
P O Box 68330 Newton, Auckland
Free Phone 0800 428428
Email: dpayne@xtra.co.nz
Internet: www.gbcsci.co.nz
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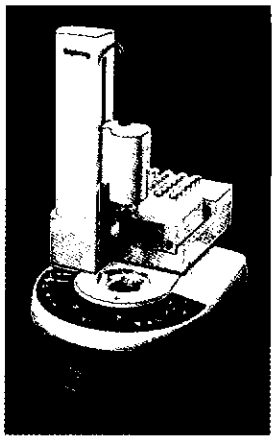
New Fully Automated Synthesis Workstation



A.i. Scientific is proud to introduce the CEM Explorer PLS for High Throughput Sequential Chemistry (HTSC). The Explorer is the newest addition to the Discover line of Focused Synthesis instrumentation. Explorer is a fully automated synthesis workstation featuring parallel throughput with sequential reaction control. Explorer integrates all of the features of the Discover System with an automated reaction handling module for maximum throughput and flexibility in a microwave-enhanced synthesis workstation. The 24-sample deck with interchangeable racks, provides unlimited reaction capability, as more racks may be queued for processing. Explorer may be run in manual or fully automated mode. The automated mode may be interupted to run in manual mode and the resumed, offering increased flexibility.

Contact: Ai Scientific, Freephone 0800 08 60 60
Email: aimail@aiscientific.com
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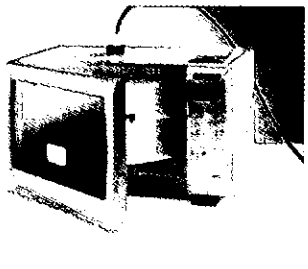
speedwave
Microwave Pressure Digestion System

Features:

- Patented no-contact infrared measurement of sample temperatures of all samples possible without contamination
- Compact case
- Massive pressure containers made of isostatically pressed TFM or Peek/TFM
- Stability of the container to all types of mineral acids including hydrofluoric acid
- Safe limit of maximum pressure through economical rupture discs
- Highest pressure stability up to 150 bar/2175 psi and a continuous working temperature of 260 °C
- In-built control for performing program and temperature guided digestions

Use:



The high performance microwave system speedwave MWS-2 for AA, ICP, ICP-MS rapid sample preparation, has proven especially useful for solving routine analysis

problems economically. Volumes from 10 mL to max. 70 mL are ideal for many areas, such as food analysis, soil analysis and quality control.

Contact: GBC Scientific (NZ)
P O Box 68330 Newton, Auckland
Free Phone 0800 428428
Email: dpayne@xtra.co.nz
Internet: www.gbcsci.co.nz
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New HPLC Refractive Index Detector

A.i. Scientific announces the release of a new differential refractive index detector for the Dionex Summit HPLC. The RI-101 delivers high sensitivity and high precision together with a range of new validation and productivity features. Built-in tests verify important instrument parameters including noise, drift, lamp age, and temperature accuracy. A start-up sequence automates purging, equilibration, autozero and the control of baseline stability and noise. An optimized temperature control system ensures fast baseline stabilization after system start. The instrument can be fully controlled by the CHROMELEON chromatography management system, or can operate in stand-alone mode. A full-colour liquid crystal display shows an online signal plot and provides fast access to instrument settings and performance parameters. The RI-101 is ideal for analysis of components with poor UV absorption such as alcohols, sugars, saccarides, fatty acids and polymers.

Contact: Ai Scientific, Freephone 0800 08 60 60
Email: aimail@aiscientific.com
circle number 34 on the reader reply card

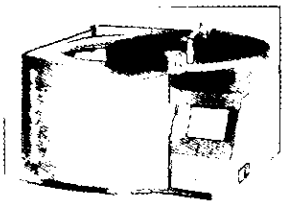
Microwave Pressure Digestion Labstation

Features:

- Long lasting value through stainless steel housing with multi-layer PTFE coating
- The swingTop offers excellent viewing conditions and optimum user-safety
- Patented no-contact infrared measurement of sample temperatures of all samples possible without contamination
- Operated via an industrial PC using colour touch screen for program and temperature-controlled pressure digestions
- Each sample temperature is displayed in real-time
- Highest pressure stability up to 150 bar/2175 psi at a volume of 100 mL and a continuous working temperature of 260 ° C
- Digestion rotors with up to 12 vessels made of isostatically pressed TFM
- Safe performance without loss of sample through economical rupture disc technology
- Stability of the vessels to all types of mineral acids including hydrofluoric acid.

Use:

The high performance microwave labstation speedwave MWS-3 for AA, ICP, ICP-MS rapid sample preparation, has proven especially useful for solving routine analysis and special analysis. The digestion vessels are sufficient for all areas. Even hard to digest samples in large volumes are no problem for the speedwave MWS-3.



Contact: GBC Scientific (NZ)
P O Box 68330 Newton, Auckland
Free Phone 0800 428428
Email: dpayne@xtra.co.nz
Internet: www.gbcsci.co.nz
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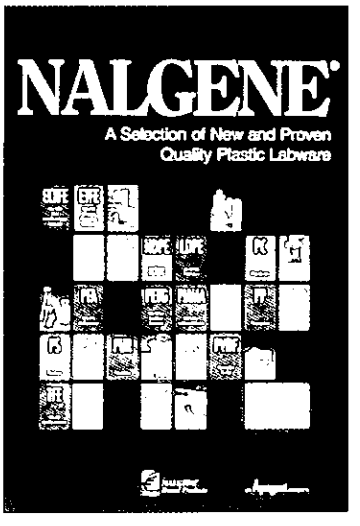
New 16-Page Brochure From Nalge Nunc International Presents 41 NALGENE® Laboratory Products



A new 16-page brochure, just published, provides detailed descriptions and ordering information for 41 selected NALGENE brand products for the modern laboratory.

The extensive range of NALGENE products includes VERSI-DRY® Lab Soakers, Single-use Erlenmeyer Flasks, Sterile HDE Bottles, B^3 Media Bags™, Freezer Racks, Dewar Flasks, Single-Use Robotic Reservoirs and more.

NALGENE Quality Plastic Labware is manufactured under ISO 9001 from 21 high-quality resins. Complete product descriptions, photos, catalogue numbers and ordering information make it easy to locate and specify NALGENE products fora wide range of laboratory applications.

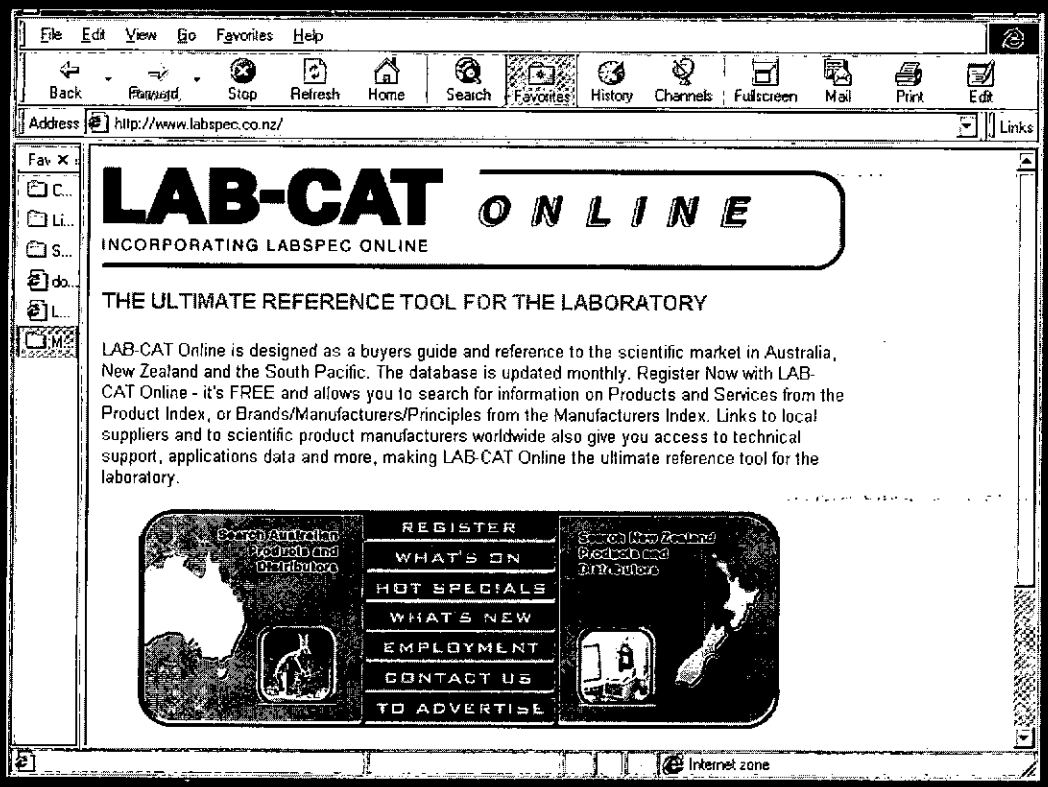
A FREE copy of the brochure may be ordered:

Contact: NNI Documentation Centre, Sevenoaks, Kent TN14 5XA, United Kingdom, Fax: (+44-1732)-453166
Internet: www.nalgenunc.com
circle number 36 on the reader reply card

New Disposable Gold Electrodes

A.i. Scientific is pleased to introduce disposable Gold Electrodes from Dionex, designed for amino acid and carbohydrate analyses. The disposable electrode product family includes two products: one certified for amino acid analysis using the Dionex AAA-Direct system with anion-exchange chromatography and amperometric detection; the other certified for carbohydrate analysis using the Dionex BioLC®. Both products are quick and simple to install and provide exceptional reproducibility and system performance. Dionex designed the Disposable Gold

LAB-CAT ONLINE



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OR

www.lab-cat.com

Information for Advertisers: www.ancat.co.nz/lab-cat.htm

Electrodes to meet the demands of scientists who expect ease of use and outstanding reproducibility, without compromising peak symmetry, resolution, or sensitivity. These new Disposable Gold Electrodes provide rapid system equilibration and exceptional electrode-to-electrode and lot-to-lot reproducibility, while maintaining the high sensitivity and resolution expected from Dionex column chemistries.

Contact: Ai Scientific, Freephone 0800 08 60 60
Email: aimail@aiscientific.com
circle number 37 on the reader reply card

Cost-Effective Dust Contaminant Measurement

The concentrations of airborne dust contaminants in a workplace can vary with process, substance, workplace practice, filtration efficiency, air movement, climate and even the actions of neighbouring operations.

Reconciling the need for on-demand monitoring with the variable and sometimes intermittent nature of hazards can be difficult and many businesses find the most cost-effective solution is to rent professional equipment when the need arises.

Andrew Perring, Sales Manager for test and measurement equipment rental company Tech-Rentals, says the DustTrak Aerosol Monitor is a hand-held instrument that will enable companies to monitor their Occupational Safety and Health obligations and meet best-practice without investing capital in equipment that may be under-utilised.

The DustTrak Aerosol Monitor is a battery operated laser-photometer that measures airborne dust concentrations in a wide range of environments.

It can quantify the dust emissions generated by a production process or unforeseen contamination, calibrate *in situ* monitoring equipment, help sites manage a one-off event - such as the demolition of a building - or check air purity in packaging, food handling and medical operations.

Real-time outputs are displayed on an easy-to-read digital display that shows concentrations in milligrams per cubic metre (ranging from 0.001 to 100 mg/m^3). The displayed data is simultaneously logged into memory that will retain many weeks of information, even at one minute sampling intervals, and stop-start times can be programmed for unattended data collection.

Stored information can be downloaded to a PC and displayed as graphs to illustrate patterns or peaks using Windows-based software supplied with the instrument.

An analogue output with four programmable user settings offers an alarm function and allows switching to automatically control machinery should dust concentrations rise above acceptable levels.

Lost production time, rejected orders or OSH issues relating to ill-defined airborne contamination need no longer be problems, now the versatile DustTrak Aerosol Monitor is available on flexible rental terms. Ex-rental units can also be purchased outright from Tech-Rentals.

Contact: Andrew Perring, Sales Manager, Tech-Rentals,
Phone: (09) 5204759, Fax: (09) 5229825
Email: andrewp@techrentals.co.nz
circle number 38 on the reader reply card

moistalyzer Moisture Analyzer BMA-400

Features:

- Broad measuring range from several ppm up to the %-range
- No sample preparation
- No expensive and environmentally dangerous solvents
- Easy to use, reproducible results
- Freely definable and storable temperature profiles (40 °C bis 400 °C)
- Graphic representation during measurement in real time
- RS 232 Interface

Use:

- Can be used almost anywhere from research and development areas to analytical laboratories to manufacturing control
- Especially useful for plastics, food, chemistry, pharmacy, semiconductor technology etc.

Contact: GBC Scientific (NZ)
P O Box 68330 Newton, Auckland
Free Phone 0800 428428
Email: dpayne@xtra.co.nz
Internet: www.gbcsci.co.nz
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Patent Proze

by Jane Calvert and Helen Palmer

Issues Surrounding The Patentability Of 3-D Structures

Many 3-D structures of proteins or molecular complexes are now determined and defined by 3-D coordinates from x-ray crystallography. With the developments in technology and crystallization techniques that allow for the structure determination of proteins and molecular complexes there is a growing trend to attempt to define the 3-D structures in patent specifications.

However, many issues arise as to whether or not the definition of such structures using 3-D coordinates should be patentable. These issues include:

• There can be a degree of variability in the x-ray co-ordinates that are defined, perhaps because of poor resolution of the x-ray data, typically because of limiting factors impacting on the ability to solve the structure. These factors can include poor crystal quality, poor data intensity and the like. The question arises then as to what sort of protection can be afforded by any patent relying on defined 3-D co-ordinates? What sort of scope of protection could you actually achieve and how different would the x-ray coordinates of an allegedly infringing 3-D structure have to be to avoid infringement?

• The 3-D coordinates of a protein structure for example, will most probably not correspond to the actual configuration of the protein *in situ*. One might then question the value of actually seeking patent protection for a 3-D structure defined using x-ray coordinates. However, the use of a 3-D structure in rational drug design, in understanding the conformation of proteins or macromolecules and the like is invaluable and can be commercially significant.

• Once the 3-D co-ordinates of the protein crystal are known is it reasonable to expect that the protein structure, as defined by the co-ordinates, is novel compared to the structure of the soluble protein? More often than not some structural details of the soluble protein have been previously published and so there is a novelty threshold that must also be overcome. If the novelty threshold can be overcome, the next question that one must satisfy is whether the crystallization and subsequent collection of x-ray data using known techniques is actually inventive. There is an argument that there may be no invention given that the techniques of crystallization, data collection and structure resolution are reasonably well established. Of course this would have to be given consideration on a case-by-case basis.

• The limited resources of patent offices to effectively conduct a search on the coordinates that are presented for novelty considerations. The US patent and trade mark office has given some consideration to this issue and considers that a 3-D structure x-ray coordinate database should be set up to enable patent offices around the world to be able to conduct searches. Our understanding at the present time is that no patent office has the capability of conducting any search on known x-ray coordinates. Typically data or information collected by routine means is not patentable. The data must have some functionality, so considerable care must be taken in the preparation of a specification and claims if a patent application is sought for the 3-D structure of a protein or molecule.

• How do you define the 3-D structure of a protein using x-ray coordinates? A search of the US patent office database alerted us to the recent publication of a patent application, US 20020051965, entitled "Modifications of the VEGF (Vascular Endothelial Growth Factor) receptor-2 protein and methods of use".

This patent application includes a claim that reads:

> *"An isolated DNA sequence comprising a DNA sequence or variants thereof encoding the VEGFR-2 gene construct having the x-ray coordinates of FIG. 5."*

While this claim has not been granted, it clearly represents an attempt to obtain protection relying on the x-ray coordinates. All the x-ray co-ordinates of this DNA sequence are provided in Figure 5 of the patent specification. Additionally, the disclosure of the x-ray data is said to be useful for the purposes of identification and construction of possible therapeutic compounds in the treatment of various diseases. This usefulness is mentioned in the patent specification to ensure that the invention meets the patentability criterion of utility.

We anticipate that over the course of the next few years the reliance on x-ray co-ordinates to define 3-D structures will become increasingly significant. We also anticipate that patentability boundaries will be pushed to their limits and patent offices will have to gear up their ability to examine and conduct searches on x-ray coordinates in the same way that we have seen them do for nucleotide and nucleic acid sequences. No doubt interesting test cases will be brought before the courts that will attempt to resolve some of the issues.

Jane Calvert

Jane Calvert and Helen Palmer are both patent attorneys and solicitors at Baldwin Shelston Waters, where they specialise in chemistry and biotechnology patents. Jane joined BSW after completing a PhD in chemistry at the University of Canterbury in 1994. Helen joined BSW in 2000. After completing a PhD in chemistry at The University of Auckland, she had a year of postdoctoral research in the USA and then two years as a postdoctoral fellow at the University of Otago.

Helen Palmer

Conference Report:
14th International IUPAC Conference on Organic Synthesis

Margaret Brimble (The University of Auckland) and Jim Coxon (University of Canterbury)

The 14th International IUPAC Conference on Organic Synthesis was held in the Christchurch Convention Centre in mid-July 2002 and was attended by close to 500 delegates, 170 of whom where graduate students. Patent attorneys from several New Zealand firms were also present demonstrating a heightened interest in New Zealand in intellectual property. The hosting of such an international conference is a significant event for New Zealand Organic Chemistry and was made possible from sponsorship by the New Zealand Institute of Chemistry, the Royal Society of New Zealand, and The Royal Australian Chemical Institute. **Professor Paul Callaghan**, President of The Royal Society of New Zealand opened the conference and **Associate Professor Roger Read**, Chair of the Organic Division of The Royal Australian Chemical Institute also spoke at the opening ceremony.

Professor Ben Feringa held a reception to launch the journal *Organic and Biomolecular Chemistry* to be published by the Royal Society of Chemistry, which is a merger of *Perkin 1* and *Perkin 2*. *Organic Letters* was a major sponsor for the meeting while the *Australian Journal of Chemistry* and the biotechnology company Neuronz Ltd sponsored the student poster prizes.

The Conference was co-chaired by **Professors Margaret Brimble** (The University of Auckland) and **Jim Coxon** (University of Canterbury) and organised with assistance from a small New Zealand-wide Committee comprising **Associate Professor Andrew Abell** and **Dr Jonathan Morris** (Canterbury), **Dr Carol Taylor** (Massey), **Professor Rob Smith** (Otago), **Dr Vittorio Caprio** (Auckland) and supported by an International Advisory Committee. **Professor David St. C. Black** (University of New South Wales), a member of the International Advisory Committee, represented IUPAC. **Professor Leiv Sydnes** (University of Bergen, Norway) the 1st Vice-President and President-elect of IUPAC was a conference delegate.

The Conference focused around nine eminent plenary lecturers: **Professors Yoshito Kishi** (Harvard), **Koichi Narasaka** and **Tohru Fukuyama** (Tokyo), **K.C. Nicolaou** (The Scripps Research Institute), **Johnathan Ellman** (Berkeley), **Ben Feringa** (Groningen), **William Roush** (Michigan), **Al Padwa** (Emory), and **Stephen Martin** (Texas at Austin).

A special event of the conference series is the award of the Theme Prize that is awarded to the scientist less than 40 years of age whose work has had a major impact on organic chemistry. At this conference the award went to **Professor Erik Carreira** from ETH Zürich. The list of Theme Prize recipients reads like a Who's Who in Organic Synthesis.

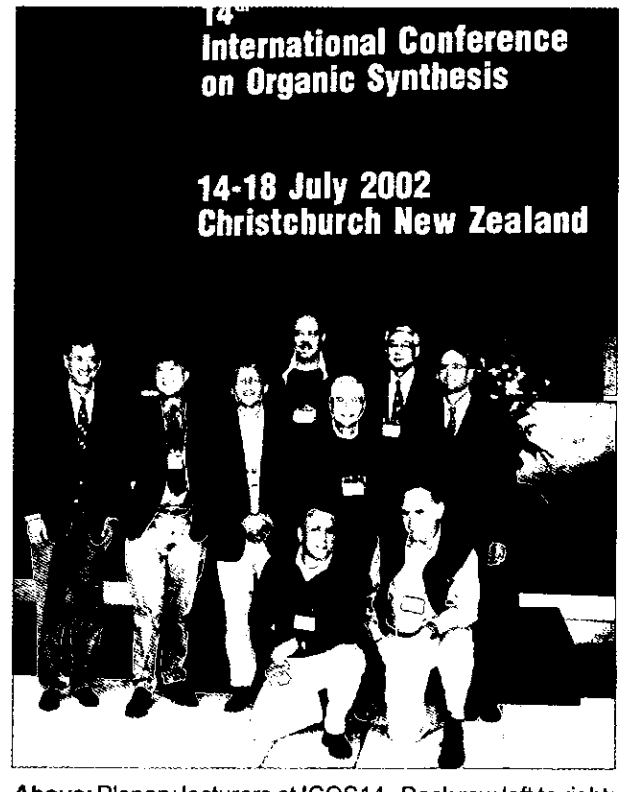
In addition to the plenary lectures there were twenty invited session lectures and six mini-symposia on synthesis of bioactive molecules, combinatorial chemistry, stereoselective synthesis, green chemistry, metal-mediated synthesis, and automation in synthesis.

The Chair of Green Chemistry Symposium, **Dr Paul Anastas**, attracted media attention as the person who coined the term "Green Chemistry". Paul is currently working with the White House Office of Science and Technology and will be returning to the University of Canterbury shortly as an Erskine Fellow.

A further 400 presentations completed a densely packed four days of new results in the field of organic synthesis. The next conference in the series is to be held in Nagoya, Japan from 1-6 August 2004. Planning is underway to host 1500-2000 delegates and build on the success of previous conferences.

Highlights of the conference, to name but a few, included the lecture by **Professor Kishi** on the synthesis of the halichondrin class of natural compounds, segments of these molecules have been shown to be exceptional anti-tumour drug candidates. **Professor Nicolaou** demonstrated the power of modern computation in his presentation achieving a new level of technicolour graphics. He gave an impressive overview of the use of the well-known Diels-Alder reaction as a pivotal step in the synthesis of many complex natural products.

David Larson (Otago) spoke on the synthesis of antibiotics, **Jonathan Morris** (Canterbury) presented his total synthesis of the marine alkaloid Variolin B, and **Professor Al Padwa** talked about cascade reactions for heterocyclic synthesis—and of course managed to remain after the conference for two days of skiing!



Above: Plenary lecturers at ICOS14. Back row left to right: W. Roush, V. Snieckus, B. Feringa, K. C. Nicolaou, Y. Kishi, K. Narasaka, E. Carreira. Front row left to right: J. Ellman, A. Padwa. (Absent: T. Fukuyama).

35th International Conference on Coordination Chemistry (ICCC35) - Heidelberg

From July 21-26, 2002 the International Conference on Coordination Chemistry took place in Heidelberg, Germany. More than 1100 chemists from 57 nations traveled to the scientific metropolis on the Neckar river to report on the latest progress in coordination chemistry and to discuss all topics of coordination chemistry in 223 lectures and 768 poster presentations.

Since 1950 the ICCC conferences (usually biannually) have been the central meetings of coordination chemists from all over the world. This year the 35th event of this series was held in Germany and the overwhelming interest (only the necessary limitation prevented a much larger number of participants) emphasised the up-to-date and attractive program compiled by the organising committee headed by Professor Gottfried Huttner, Dr Elisabeth Kaifer, and Professor Roland Krämer. The romantic city of Heidelberg proved to be an excellent location for the conference, and the wine reception held on the terrace of Heidelberg Castle garden, while watching the sun set over the Neckar valley was a memorable occasion.

The diversity of modern coordination chemistry and its evolution to provide links between the modern objectives of chemistry has been impressively demonstrated whether through bioinorganic chemistry, molecular precursors for novel materials, supramolecular chemistry, or homogeneous metal catalysis. In all cases coordination units constitute the fundamental building blocks. An interesting feature of the program was that half of the plenary lectures were presented after the opening session in the Heidelberg Convention Centre in a special program on the first day of the conference. The remaining plenary sessions were spread over the remaining four days of the conference at the main venue, the Neuenheimer Feld campus of the University of Heidelberg.

The plenary lectures covered all the topics of modern coordination chemistry. Itamar Willner (Jerusalem) gave an account of the development of functional nanostructures elaborately composed of coordination units, biopolymers and surfaces to construct modules of electronic, electrocatalytic and optoelectronic devices. Dante Gatteschi (Florence) elucidated the strategies for achieving and understanding high magnetic anisotropies in single molecules – anisotropy is the fundamental prerequisite for molecular magnetism and a thorough understanding of it is necessary for the improvement of magnetic properties and for future application in nanomagnets. The fact that the mechanism of metallocene-catalysed olefin polymerisation can be conceived only if the so-far neglected "non-coordinating" counteranions are also taken into account was demonstrated by Hans H. Brintzinger (Konstanz). The Wilkinson prize awarded to Achim Müller (Bielefeld) was a highlight, and his impressive acceptance lecture showed the controlled construction, transformation, nesting, and combination of giant molecular polyoxometallate balls, disks and rings with up to 264 metal atoms – coordination chemistry in a novel dimension. Finally, Robin J. H. Clark (London) entertained the audience with his colourful presentation concerning the analysis of inorganic pigments used in arts. Raman microscopy not only allows for the identification of pigments, and therefore to date and assign artwork, but also to discover art forgeries as shown by several spectacular examples. The further plenary lectures covered the topics of self organisation of coordination cage compounds and control of chemical reactions in such supramolecular vessels (M. Fujita, Tokio), structure elucidation of photosystem-I with more than 96 cofactors and of the unique Mn4 cluster in the water-oxidising complex of photosystem-II (P. Fromme, Berlin), synthesis and electronic analysis of novel, inverted sandwich compounds of uranium (C. C. Cummins, Massachusetts), luminescent materials with variable absorption and emission characteristics rationally synthesised using a coordination chemistry approach (V. W.-W. Yam, Hong Kong), and complexes of lanthanide ions with expanded and modified porphyrins which have advanced to clinical testing as anticancer drugs (J. L. Sessler, Austin/Texas). These contributions show once more that fundamental research, especially in the interdisciplinary field of coordination chemistry, leads to new insights and beautiful results as well as new applications.

The numerous oral presentations were organised in six parallel sessions (Bioinorganic Chemistry, Metals in Medicine, Metals in Catalysis, Werner Type Complexes, Supramolecular Coordination Chemistry, Materials and Nanochemistry) and gave many young scientists the opportunity to present their results. The two poster sessions constituted an integral part of the conference where the participants actively and vividly discussed all aspects of coordination chemistry and socialised with each other. The fact that many discussions and conversations lasted far into the night was last but not least due to the excellent organization. The pleasant environment and the special ambience of the conference location contributed considerably to the great success of the ICCC35 - Heidelberg and modern coordination chemistry at its best!

New Zealand historically has had a strong presence at ICCC meetings, and on this occasion participants from Auckland, Canterbury and Otago, as well as expatriate Kiwis currently working overseas, attended the meeting and contributed to the oral and poster sessions. The planning meeting held as part of the conference identified the time and location of the next meetings in the series – Merida (Mexico) in 2004, Capetown (South Africa) in 2006, Jerusalem (Israel) in 2008 and, closer to home, Adelaide (Australia) in 2010.

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Based on a report originally compiled by Franc Meyer (Göttingen, Germany).

REFORM OF THE NEW ZEALAND PATENTS ACT – WHY SHOULD YOU CARE?

Mark Paton
Baldwin Shelston Waters, Auckland

There has been a drive in recent years for the New Zealand research community to commercialise more of its results with a view to expanding the fledgling knowledge-based economy. It is recognised in industry and in Government that an integral part of expanding this knowledge economy requires New Zealand to strengthen its intellectual property protection laws, and particularly its patent laws.

In a step towards this, in March 2002 the Ministry of Economic Development released a discussion paper intended to provide a framework for reforming the New Zealand Patents Act. Submissions in response to the discussion paper were due on 26 July 2002.

Many of the proposed amendments will bring New Zealand's patent laws into conformity with our nearest trading partners, for example the amendments to the patentability requirements. These amendments raise the threshold for obtaining patent protection in New Zealand. Raising the standard of novelty and inventiveness required to obtain patent protection in New Zealand will raise the international standing, calibre, and commercial worth of a New Zealand patent.

The increased commercial worth of New Zealand patents obtained under these amendments may have flow-on effects. If the standard required to obtain patent protection is higher this could attract more offshore investment in New Zealand research and development. This is because a New Zealand patent application held by a research group may have greater credibility and more weight as a bargaining tool to attract investors, international partners and collaborators. Naturally, this is good for New Zealand researchers.

Another benefit of raising the standard required for obtaining a New Zealand patent may, for example, be the provision of greater certainty for local researchers as to what they can do without infringing another party's patent. The current patentability tests in New Zealand are seen by some as too liberal and result in patents which are overly broad. This blurs the boundaries of what local researchers can and cannot do without infringing a patent.

While the amendments to the Patents Act are likely to have the benefits dicscussed above, raising the bar may have the effect of increasing the time which researchers and patent attorneys are required to spend preparing New Zealand patent applications and responding to objections raised to patent applications by the Intellectual Property Office of New Zealand (IPONZ). This in turn may increase the cost of obtaining protection.

Why is Reform Necessary?

Reform of the New Zealand Patents Act is long overdue. Reasons mentioned in the discussion paper for making amendments to the Patents Act include:

- ensuring that patents are granted only for genuine innovations;
- making a positive contribution to New Zealand's economic development and the Government's objective of developing a "knowledge economy";
- providing adequate incentives for overseas innovators to transfer their technology to New Zealand; and
- dealing appropriately with the concerns expressed by Maori regarding the patenting of inventions involving traditional knowledge and indigenous plants and animals.

The Reforms Under Discussion

Reform to the Patents Act could have a considerable impact on the direction of research in New Zealand. The areas in chemistry most likely to be affected by the reform include natural products chemistry, drug development chemistry, and chemical research directed at identifying second medical uses for known drugs.

Maori Concerns: A Threat to Natural Products Chemistry?
Proposals to amend the Patents Act to address Maori concerns could impact on obtaining patent protection in New Zealand for natural products chemistry. These concerns centre on modification to life forms and on the Crown's obligations under the Treaty of Waitangi to protect Maori interests.

There is considerable sympathy in many circles with the view that the intellectual property of indigenous people should be protected from exploitation by multinational companies. The discussion paper puts forward a number of alternative proposals to address Maori cultural concerns and the Government's obligations under the Treaty of Waitangi. The alternative proposals include the following:

(1) that the Patents Act be amended to ensure consultation with Maori occurs when patent applications are made for inventions that are based on traditional knowledge or relate to life forms or genetic material;

(2) the introduction of a requirement that a patent applicant provide evidence as to the source of any genetic material

utilised in an invention, as well as evidence of informed consent where traditional knowledge has been relied upon in arriving at an invention;

(3) in respect of the recognition and protection of Maori traditional knowledge it is suggested that separate legislation be drafted to address concerns, rather than amending the current patent legislation. This would result in the establishment of a traditional knowledge *sui generis* system.

If proposal (1) or (2) were to be introduced the onus of answering concerns raised during such a cultural examination process would fall on the researcher. It is difficult to see how academic or pharmaceutical chemists could adequately address such concerns raised by a cultural body without considerable cultural and legal advice.

So if proposal (1) or (2) were accepted as a way of addressing cultural concerns, how could they affect natural products chemistry? Let us say that the leaves from a particular tree have been used by Maori for many years to treat skin complaints. Maori rub a leaf from the tree onto peeling skin as the treatment. The effect of this treatment is to relieve irritation.

A natural products chemist obtains samples of the leaf, isolates and purifies an active component from the leaf, and shows that it has anti-tumour properties. The chemist establishes the biosynthesis of the active component and goes on to develop a synthetic route, using catalytic amounts of cobalt, to produce the component in a reasonable yield. The synthesised active component is used to prepare a targeted anti-tumour drug to be used in a pharmaceutical preparation.

If the Patents Act were amended to provide for cultural examination (envisaged by proposals (1) and (2)), it is unclear whether objections could be raised by a cultural body to patent applications for such an active component, the synthetic route to produce the active component, or even the pharmaceutical preparation, which includes the active component. However, the adoption of separate legislation, as is contemplated by proposal (3), to address exploitation and management of traditional knowledge is consistent with some international policy proposals and legislation in certain other countries where indigenous peoples have voiced similar concerns. Such legislation would provide a basis for protecting traditional knowledge while satisfying the commercial requirements of the Patents Act.

As a general point, it should be noted that under New Zealand's current patent laws, there are a number of avenues that Maori can use to object to patents or patent applications on the basis that a particular invention is not proper subject matter for a patent or is otherwise contrary to morality. Also, patents cannot be used to stop anyone, including Maori, doing something they have been doing since before the date the patent application was filed.

The Aspirin Dilemma: Methods Of Medical Treatment Of Humans

Although there is no specific exclusion in the Patents Act to the patentability of methods of medical treatment of humans, it has been the practice of IPONZ to reject patent applications directed to such methods. The basis for rejecting such applications is to avoid a perceived risk that medical practitioners could be put at risk of infringing a patent when attempting to preserve human life.

Under current practice, known compounds discovered to have a novel second medical use are also excluded from protection. A good example of second medical use is the discovery that aspirin was useful in reducing the risk of heart disease. Under current New Zealand practice the substance cannot be patented, as it is not new *per se*. As methods of medical treatment are not protectable, the researcher may be left with nothing to protect—although a skilled patent attorney may be able to word an application to enable some degree of protection.

Despite the limited protection options available, it is suggested in the discussion paper that not being able to obtain protection for methods of medical treatment or substances based on discovery of a second medical use leaves researchers with limited avenues to recoup costs. A difficulty with this is that it provides no incentive to investigate novel treatment methods or new properties of existing drugs.

The discussion paper provides three possible proposals for dealing with patent protection for methods of medical treatment:

(1) that IPONZ continue to refuse to grant patents for methods of medical treatment;

(2) that IPONZ allow patents to be granted for methods of medical treatment;

(3) that IPONZ allow patents for methods of medical treatment, but exempt medical practitioners from infringement.

Proposal (3) is the current approach taken by the United States and it appears to provide an incentive to investigate existing drugs and new treatment methods, whilst protecting individual medical practitioners from patent infringement in the pursuit of saving life. Whatever approach is adopted, the acceptability of patent protection for medical treatment inventions in New Zealand will at last be clarified by statute.

Gene Sequences And Specific Utility

There is concern that under the current system in New Zealand patents may be granted to applicants who have merely discovered random gene sequences without identifying their function, and linking that function to a specific commercial end. It is considered that the mere discovery of a gene sequence without identification of function and specific utility does not amount to invention.

For example, an individual may have generated partial sequence data for a number of genes by routine means. While not understanding the specific function of the genes it is possible the researchers may currently be granted a patent on the basis that the partial sequence data may be put to a generic use, such as providing *e*xpressed *s*equence *t*ags (ESTs), or alternative molecular probes that may be used to isolate full length genes.

In order to address concerns relating to the grant of patents for gene sequences, the discussion paper proposes that a "utility" requirement be introduced at the IPONZ level. Depending on how the utility requirement is administered, it may allow IPONZ to reject applications at the examination stage where there is no indication of the function of any gene that has been discovered, or of a specific use to which the gene sequence may be put.

The requirement that a gene has a specific "utility" means that if protection is desired for a sequence in New Zealand a clear function will need to be specified. Amending the legislation to provide for the above will more closely align requirements in New Zealand with corresponding requirements in the United States, for example.

The Reform Most Likely To Occur: Patentability Amendments

In addition to these reforms, the discussion paper indicates that certain amendments to the patentability requirements should be made. The patentability requirement throughout the world, including New Zealand, specifies that to be patentable an invention must be novel (or new) and have an inventive step.

The way in which novelty and inventive step are assessed in New Zealand is currently out of step with the rest of the world. The discussion paper indicates that the patentability requirements will be conformed to more closely reflect those of our trading partners.

Novelty

Under current New Zealand patent law an invention must not have been made publicly available in New Zealand through use or publication prior to the filing of a patent application. Disclosure of the invention in New Zealand only, by publication or use, prior to filing a patent application will usually invalidate a patent application or patent.

The discussion paper states that this requirement should be reformed so that use or publication of an invention *anywhere in the world* prior to the filing of the patent application would prevent the granting of a patent for that invention. This amendment is consistent with legislation in many countries with which New Zealand trades, for example, Australia and Europe. The United States has similar, but not identical, novelty laws to these.

In reality this reform may have little practical effect on New Zealand researchers. Currently overseas scientific journals are available in New Zealand almost immediately after they are published. Furthermore, IPONZ retains in its library patents and published patent applications that have been filed at foreign patent offices.

Inventive Step

Under the current Patents Act, IPONZ does not assess an application for the presence of an inventive step. This means that many patents are granted in New Zealand for innovations that are not truly inventive developments over what has gone before them. Generally, an inventive step requires that the invention does not merely represent a development which would be considered obvious to a person skilled in the area of technology to which the invention relates. Currently, only third parties may argue that a patent lacks an inventive step after acceptance of an application by IPONZ or the grant of a patent.

According to the discussion paper the test for inventive step should be modified so that IPONZ may raise objections to patent applications during examination on the basis that they lack an inventive step. This proposed amendment may mean that patent attorneys will require more guidance from researchers in order to establish why the research is truly "inventive", so as to gain the acceptance of an application. Examining for an inventive step means that New Zealand patents will have a higher standing which may potentially increase their commercial value.

Summary

Irrespective of the final decisions that are made on the basis of the discussion paper, it is certain that the Patents Act will be reformed. Based on the proposals, the reforms may result in an increase in the time required to be spent by researchers and patent attorneys to obtain patent protection in New Zealand.

However, amendments to the Patents Act are welcomed insofar as they clarify current IPONZ practice and align New Zealand's patent laws with those of our overseas trading partners. The higher standard required to obtain a New Zealand patent under such amendments will increase the commercial value of New Zealand patents which could offset any additional costs in obtaining protection.

To expand the knowledge economy, the aim of the New Zealand Patents Act should be to provide a solid base to power New Zealand innovation. To achieve this, the Patents Act must provide clear, efficient, effective, and expedient patent laws. Reform of the Patents Act can encourage economic growth only where reform concentrates on clarifying the law and not by adding additional complexities or ambiguities.

The fact that amending the Patents Act is at the bottom of the legislative agenda appears to be inconsistent with the Government's commitment to expanding the knowledge economy. Whilst reform is certain, do not expect reforms to the Patents Act tomorrow or next week or even next year!

This review provides a broad overview of the proposed reform only and is not intended to be exhaustive. Further information on the discussion paper is available at: www.med.govt.nz

WELL IF IT'S NOT "BOTOX", THEN WHAT IS IT??

Kensaku Takase
Baldwin Shelston Waters, Auckland

Negligent use of **BOTOX®** and other multimillion dollar trade marks is putting these marks at risk of becoming generic – so allowing rival companies to use the marks for their own pharmaceuticals.

The amount of time and money that is spent on research and development of pharmaceutical products these days is phenomenal. Patents are filed to protect the inventive elements of the pharmaceutical, and when granted patent registration, the owner has a monopoly over the invented pharmaceutical for 20 years. However, 20 years is not necessarily a long time, especially if it takes a number of years after the application date of the patent for the pharmaceutical to reach the market place. In fact, it is not uncommon for a pharmaceutical company to get only a few years of income from products protected by its patents. On the other hand, trade marks *when properly used* can assist in generating income for pharmaceutical companies long after patent protection ceases.

Most pharmaceutical companies spend a huge amount of time and money developing brand names for their new drugs, so they can create a strong market presence. So long as these brand names are distinctive, they can be protected through trade mark registration. Yet many pharmaceutical companies appear to be neglecting correct usage of their trade marks, putting these valuable assets at risk of becoming generic.

A generic term is a term used for describing a particular product. Generic terms cannot act as trade marks because they cannot distinguish the goods or services of one pharmaceutical company from those of another. A registered trade mark which becomes generic is at risk of being removed from the trade marks register, so that it is available for unrestricted use by others. For example, is "aspirin" a brand or a generic term? Or in other words, if this white pill is not an "aspirin", then what is it? This was a question asked back in 1921 when Bayer had a trade mark registration in the US for the word **ASPIRIN**. Bayer's patent protection lapsed after 20 years, so it was heavily reliant upon its trade mark registration to protect its market share.

The chemical name for the pharmaceutical was acetyl salicylic acid, a mouthful for the average consumer. Because it did not have another form of simple reference for consumers, the product became known merely as "aspirin", and the public associated the word "aspirin", not with Bayer, but with a headache treatment product. Bayer's registration was later challenged by another trader, who succeeded in convincing the US court that "aspirin" had become generic.

Any trader can now use "aspirin" for their own acetyl salicylic acid in the United States and New Zealand, and not worry about trade mark infringement. Naturally you would expect pharmaceutical companies more than 80 years later to have learned a valuable lesson from the aspirin case. Unfortunately, recent activity shows that this is not the situation.

Many high profile trade marks are being used by the trade, the public,or even their owners as a descriptor, rather than a trade mark. For example, **BOTOX®**, **VIAGRA®**, **PROZAC®**, **VENTOLIN®**. All are registered trade marks in New Zealand, but are potentially vulnerable for removal for being generic.

Let's pick on "botox". If it's not "botox" then what is it? Technically, it is botulinum toxin, but is that what the trade or the public refers to it as? You don't hear of **BOTOX®** botulinum toxin being used by doctors, nor do you hear of "botulinum toxin parties". The lack of an alternative reference for a product is a sure way to destroy a valuable trade mark.

If doctors, pharmacists, pharmaceutical manufacturers, or others in the pharmaceutical industry take "botox" as a type of product rather than a trade mark, then "botox" will become generic, and the owner will no longer have exclusive rights to use it.

The Trade Marks Bill, due to be enacted over the next year, increases the threat to trade marks vulnerable to genericism. It lowers the threshold by which a mark can become generic. A registered trade mark will be able to be removed if it has become a common name used by the general public. In other words, even if the pharmaceutical industry is well aware that "botox" is a registered trade mark, if your average botulinum toxin consuming New Zealander, Joe Bloggs or Jane Wrinkle, refers to "botox" as a generic name, then it can be challenged.

So why do pharmaceutical companies allow their trade marks to become generic? In most instances it appears to be the lack of awareness by the companies and their marketers of the threat of genericism. It is a common misconception that extensive generic use of their brand in the market place is an indication of successful marketing, but how can that be if in turn the quality control of the brand is lost forever?

Another misconception is that if their trade mark is registered that it will be safe if it is used, or that if there is no alternative word for the product that the company will gain a monopoly in the market place. The aspirin case shows that this is not necessarily the situation, and perhaps the opposite is what they are achieving – they may be opening the door for a competitor to use the term, as well as losing their trade mark registration.

It may be too late for the owner of the **BOTOX®** registration to cure the existing misuse of its trade mark in the trade and in the public. If you develop a trade mark for your chemical or drug, you can minimise the chance of the trade mark becoming generic by:

- Using the ® symbol with the registered trade mark in all instances. This puts the trade and public on notice that the mark is a registered trade mark and not a descriptor. For example, **BOTOX®**. Only use the TM symbol if the mark is not registered.
- Ensuring that there is an alternative term for the product. Do not allow the brand to become a unique descriptor or name for the goods. For example, **PANADOL®** paracetamol.
- Educating the trade and the public of correct usage of the trade marks, for instance by advertising.
- Immediately contacting those who misuse the trade mark as a descriptor, regardless of whether they are traders or consumers.

OBITUARY: John Woollen Tomlinson

(1927-2002)

John Woollen Tomlinson was born in the village of Dore near Sheffield, England on 23 November 1927, only child of Claude Tomlinson and Dorothy Woollen. He attended Buxton College, Yorkshire, before moving to London University.

John Tomlinson graduated BSc with Honours in 1948 and PhD in physical chemistry the following year from the Royal College of Science, later renamed as Imperial College. Research for his PhD was under the supervision of Professor John Bockris. Then followed postdoctoral study at the Massachusetts Institute of Technology before he returned to Imperial College where he tackled such phenomena as the solubility of water in molten sodium silicate and the electrical conductivity of molten iron oxide—physical chemistry under exceedingly challenging experimental conditions.

In 1966, John was appointed to the inaugural Chair of Physical Chemistry at the Victoria University of Wellington. He gathered around him a group of electrochemists with interests in research at high temperatures and pressures and was instrumental in the formation of the Joint Mineral Sciences Laboratory, a collaboration between the Chemistry and Geology Departments, for the study of mineral systems at high temperatures and pressures.

As Professor of Physical Chemistry, John supported and encouraged colleagues and students alike. He was dedicated to quality at all levels. Many of his graduate students have moved on to prestigious institutions overseas. He believed that the teaching laboratories should, wherever possible, have research quality equipment and that experiments should reflect modern trends as much as traditional fundamental techniques. Some students were heard to "complain" that experiments in the physical chemistry laboratory always worked, testimony to the preparation that he always insisted upon. Visiting electrochemists took away copies of the undergraduate laboratory manuals to help them incorporate "modern experiments" in their own courses.

As a professor in the university, he took his turn at administrative duties serving as convener of various committees, Chairman of Department, Executive Dean of Science, Deputy Vice-Chancellor, and Acting Vice-Chancellor. As Deputy Vice-Chancellor, he gained some notoriety in the local press by taking up motorcycle riding, an activity for which he displayed great enthusiasm despite a collision with a truck. Rusting fuel tanks and fogging visors became topics for lectures on corrosion and surface chemistry.

As an administrator his strategy at meetings was simple and effective. He would argue vehemently against proposals about which he had little passion before finally giving way and then, when there were issues about which he felt strongly, he would simply remind people that he had yielded before and now it was his turn to win. He had a profound sense of fair play and this manipulation of the "meeting process" to achieve what he saw as the correct outcome was "within the rules of the game" as he saw things. His sense of fair play was demonstrated very strongly during his eight years as convener of the Scholarships Committee where he "worked" strenuously to achieve equitable outcomes.

Following his retirement from the university at the end of 1990, after twenty-four years as Professor of Physical Chemistry, the chair was disestablished so that John Tomlinson was the first and only holder of the Chair of Physical Chemistry at Victoria University of Wellington. He was elected to the position of Professor Emeritus the following year.

John was a *raconteur par excellence* and enlivened lectures and social gatherings with a wide assortment of tales. He had wide-ranging interests; wine, food, music, literature, fishing, and sport (he had half colours from Imperial College in squash and fencing). He remained an enthusiastic and competitive (though not overly successful) squash player until his final illness. John's love of food can perhaps be traced to his maternal grandfather, who lived with the family and managed Arthur Davies and Sons Ltd., a prestige grocer and restaurant business in the centre of Sheffield. On the other hand, blowing a hole in the bathroom basin while "experimenting" with lumps of sodium during his parents' absence can better be attributed to scientific curiosity rather than to his grandfather's influence! Everything John undertook was tackled with the same enquiring, scientific mind, be it the structure of fly-casting rods or the use of computers. When the physical chemistry section took delivery of its first Hewlett-Packard 86B computer, he sat down, with the manual in his hand, to master the art of programming and soon had a simple program which, despite every instruction being totally legitimate, locked up the computer (long before a well-known software house was able to achieve the same feat) so that the only option was to turn off the power.

John Tomlinson left a hole when he retired, a hole that became deeper as his long illness advanced. He died at the Huntleigh Home and Hospital on 9th August 2002. His passing marks the end of an era in Chemistry at Victoria University. He is survived by his wife, Dianne, and four children.

P. J. Pearce
Victoria University

CONFERENCES & SEMINARS

29 September - 3 October 2002
ComBio 2002
Darling Harbour Convention Centre Sydney
New South Wales, Australia
Contact: Philip Kuchel
p.kuchel@biochem.usyd.edu.au
http://www.asbmb.org.au/combio2002

2-3 October 2002
ICOLA'02 The First International Conference On "Opto-electrotechniques And Laser Applications
Jakatra, Indonesia
Contact: Suganda Jutamulia
suganda@blueskyresearch.com
http://www.geocities.com/icola2002

7-8 October 2002
New Zealand Energy Conference 2002 - The Way Forward
Duxton Hotel, Wellington, New Zealand
Contact: Coal Research Ltd
energyconference@crl.co.nz

11 October 2002
Productivity, Growth and Partnership - GIAB Forum
Contact: Rick Christie
GIAB
Phone: (04) 4720251

17 October 2002 (7.30 pm)
Charles Fleming Lecture: Professor John Craig
APEC Room, Auckland Museum, Auckland

20-25 October 2002
28th Meeting Of The Federation Of European Biochemical Societies
Jerusalem, Israel
Contact: Conference Secretariat
28th International Conference
P O Box 50006, Tel Aviv 61500, Israel
www.kenes.com/febs

15-17 November 2002
Conference Of The Royal New Zealand Institute Of Horticulture
Plymouth International Hotel
New Plymouth, New Zealand
rnzih@xtra.co.nz
www.rnzih.org.nz/pages/news.html#conference2002

17-20 November 2002
The 8th International Pacific Rim Biotechnology Conference
Auckland, New Zealand
Contact: Ted Jones
Avenues Event Management
P O Box 10612 Wellington, New Zealand
Ted@avenues.co.nz
http://www.pacrimbiotechnology.com

20-22 November 2002
"Vulnerability" Meteorological Society of New Zealand Conference
Sky City, Auckland
http://metsoc.rsnz.org/2002.html

22 November 2002
Royal Society Academy Council Conference: "Being Human: "Science Culture And Fear"
Te Papa, Wellington, New Zealand
gill.sutherland@rsnz.org

25-29 November 2002
New Zealand Soil Science Society Golden Jubilee Conference
Victoria University of Wellington, Wellington
Contact: Janet Simes
organiser@conferences.co.nz
www.rsnz.govt.nz/clan/nzsss/index.htm

25-29 November 2002
17th Annual DNA Technology Workshop
An introduction to the theory and practice of DNA technology.
Turitea Campus, Massey University, Palmerston North
Contact: Dr Rosie Bradshaw
Institute of Molecular Biosciences, Massey University
Private Bag 11-222, Palmerston North
R.E.Bradshaw@massey.ac.nz
http://www.imbs.massey.ac.nz/workshop.htm

26-29 November 2002
Microbes And Molecules 2002
The annual combined meeting of the New Zealand Microbiology Society, The New Zealand Society for Plant Physiology, and the New Zealand Society for Biochemistry and Molecular Biology.
University Of Canterbury, Christchurch New Zealand
www.conference.canterbury.as.nz/microbes2002/

29-30 November 2002
The 37th Annual Conference Of The Operational Research Society Of New Zealand
The University Of Auckland, Auckland, New Zealand
Contact: Matthias Ehgrott
m.ehrgott@auckland.ac.nz
http://www.orsnz.org.nz

2-6 December 2002
Geological Society Of New Zealand's Annual Conference "Northland 2002"
Forum North, Whangarei
http://www.gsnz.org.nz/gsco.htm

CONFERENCES & SEMINARS

3-6 December 2002
NZ Hydrological Society Symposium "The Easy Water Is Gone: Making The Most Of A Scarce Resource"
Blenheim, New Zealand
cmi@marlborough.govt.nz
http://www.hydrologynz.org.nz/society-conferences.html

5-8 December 2002
The New Zealand Association For Research In Education Annual Conference
Massey University, Palmerston North, New Zealand
nzare-conf02@massey.ac.nz

8-11 December 2002
19th International ASCILITE (Australian Society for Computers In Learning In Tertiary Education)
http://www.unitec.ac.nz/ascilite

6-10 January 2003
10th International Symposium On Deep Seismic Profiling Of The Continents And Their Margins
Taupo, New Zealand
http://www.gns.cri.nz/news/conferences/seismix2003

2-7 February 2003
ICPP 8th International Congress Of Plant Pathology
Christchurch Convention Centre, Christchurch, New Zealand
Contact: John Fletcher
New Zealand Institute for Crop & Food Research
Private Bag 4704, Christchurch, New Zealand
FletcherJ@crop.cri.nz
www.lincoln.ac.nz/icpp2003/

4-7 February 2003
Australasian Quaternary Association (AQUA) Biennial Conference in association with the New Zealand Friends Of The Pleistocene
www.geo.vuw.ac.nz/conferences/aqua03/index.html

24-28 March 2003
7th International Conference On Southern Hemisphere Meterology And Oceanography
Wellington, New Zealand
Meterological and Marine Sciences Societies

24-26 March 2003
Fifth International Conference On Electromagnetical Wave Interaction With Water And Moisture Substances
Novotel Hotel, Rotorua, New
Zealandk.thankur@irl.cri.nz

6-11 July 2003
"Windows On A Changing World" - 22nd Conference Of The New Zealand Geographical Society
The University of Auckland, Auckland
Contact: J Logie
The University of Auckland
nzgs2003@sges.auckland.ac.nz
www.geog.auckland.ac.nz/nzgs2003/

7-11 July 2003
Fifth International Conference On Industrial And Applied Mathematics
Sydney, New South Wales, Australia
http://www.iciam.org

9-11 July 2003
The New Zealand Insitute Of Physics Conference and Physikos 2003
Massey University, Palmerston North

1-5 December 2003
3rd International Wildlife Management Conference
Christchurch, New Zealand
www.conference.canterbury.nz/wildlife2003

YOUNG SCIENTISTS GLOBAL CHANGE CONFERENCE 2003

The Young Scientists' Global Change Conference, scheduled for 16-19 November 2003 in Trieste, Italy, offers a platform for young scientists to present their research findings to leading scientists in the field. It is intended to stimulate competition, encourage excellence, reward outstanding performance, and encourage the development of personal and institutional networks. Awards will be presented for the most outstanding contributions, including Best Paper. Distinguished invited keynote speakers will give plenary presentations. The language of the conference is English.

Submissions of papers and posters are invited from young scientists (aged 35 years or under) on the physical, biological and human aspects of global change. Abstracts not exceeding 300 words are due on Friday 14 March 2003. Email Eddie.Davis@rsnz.org for further details.

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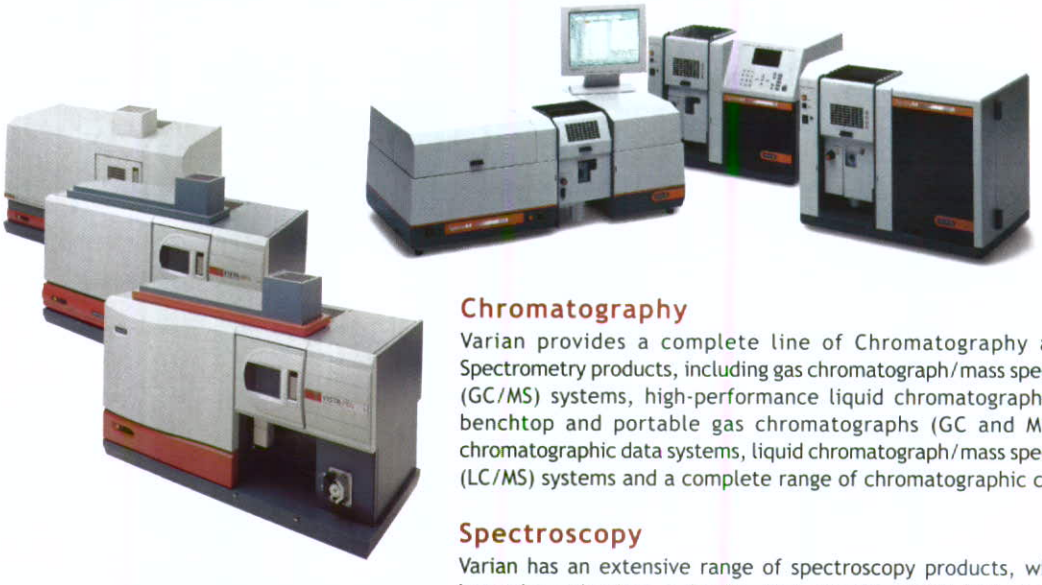

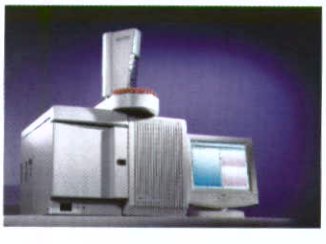

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